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PREDICTION OF SUCCESS IN PROFESSIONAL COURSES FOR TEACHERS

BY

LAURA B. M. KRIEGER, P_H.D.

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L. B. M. K.

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PREDICTION OF SUCCESS IN PROFESSIONAL COURSES FOR TEACHERS

CHAPTER I

INTRODUCTION

With the increasing demand for more adequately prepared teachers and administrators in the teaching profession, men and women are entering our teacher-training institutions in overwhelming numbers each year. Nearly twelve thousand (11,965) students have registered in the largest teachers' college in this country in one year, including both the academic year and the summer session. Of this number more than three thousand (3,441) were graduate students, registered during the academic year. Just ten years previous to this (1918-19), the annual registration was approximately four thousand (4,135), and the number of graduate students during the academic year was less than eight hundred (778). This rate of increase is true not only of one institution but also, in greater or less degree, of practically all teacher-training institutions in the country. Consequently, the methods of instruction and courses of study in teacher-training institutions have had to undergo rapid changes in order to fit the needs of the increasing numbers of students.

Some colleges and universities have found it necessary to limit the number of entering students by methods of selection designed to secure the most desirable from among the candidates. Others have not wished to deprive any applicant of any educational opportunity from which he could derive normal profit. These latter schools have found it necessary to consider methods of selection of the type of curriculum from which a given individual, whether bright or dull, can profit. In small colleges it is practically necessary to adjust the student to the curriculum,

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but in large institutions the possibilities for fitting the curriculum to the students' needs become proportionately greater.

The problem of guiding students intelligently increases, however, with a more flexible and differentiating course of study. It becomes increasingly possible for good students to choose more intensive courses, while the poor students can gain greater profit from easier courses. Consequently, the necessity of separating the good students from the poor students becomes an administrative problem.

Many undergraduate colleges do not attempt to differentiate their students until after the beginning of the third year, at which time, they believe, guidance can be most effective and profitable. Some colleges attempt an earlier and tentative classification of their students by making changes whenever desirable. In graduate institutions the students are generally enrolled for a much shorter time, and proper guidance of their work demands an early knowledge about them. Previous records of graduate students are comparatively unreliable since the standards and marking systems vary considerably throughout the country and during a period of years.

Entrance examinations have been used for decades as a means of selection by colleges anxious to maintain high standards. They have been used in a lesser degree for purposes of classification or guidance of students after entrance. Early College Entrance Examinations were primarily of the essay type. Thorndike [71]* attacked this type of examination as a result of a study of the records of entrance examinations and academic careers of students in 1901, 1902, and 1903. He found that of six students who made the same average entrance mark, in their junior year one averaged a trifle above D, one had an average ranging from D to C, one averaged C+, and two averaged A. Of students ranking in the lower half of entrance examinations, nearly 40 per cent were in the upper half of their class in the last three years of college. As a result of this study Thorndike proposed that the actual success in college of candidates endorsed by a school be studied. Those schools that certified satisfactory students should be considered accredited schools, and their students should not be required to take the College Entrance Exam-

* Bracketed numbers throughout this study refer to items listed in the Bibliography.

inations. Students not certified by accredited schools would be examined. Thorndike, in making this proposal, said:

Such a system is rational because it measures the ability of schools to fit for college, not their ability to forearm students against the twin cataclysms of preliminary and final examinations. It puts the premium on capacity and right habits of intellectual work, rather than on the mass of information held in solution at a given week.

More and more, the basis of prediction of success in colleges and universities includes not only academic fitness but "native" ability. Ruch in 1925 [61] reported the scope of the college qualifying examinations as:

1. General mental ability.
2. Previous academic training.
3. Volitional, emotional, and personality factors.
4. Records of social, economic, and general home conditions.

There have been in use in colleges and universities two types of psychological tests: first, since 1890, tests of special aspects of intelligence; second, since 1918, tests of general intelligence. The early use of tests of intelligence is summarized by Roberts [59]:

Anything back of 1910 in this field is ancient history. The story of intelligence tests begins with the foundational experiments of Galton in England, Ebbinghaus and Münsterberg in Germany, Binet in France, and Cattell, Jastrow, Hall, and others in America in the '80's and '90's. The first psychological inventory in America was the ten tests devised by Cattell at the University of Pennsylvania in 1890, and the high mark of the period was reached by Cattell and Farrand at Columbia in 1896 in their individual tests with 100 students. Many of the measures were physical. . . . The mental tests were for memory and imagery, both subjective.

Roberts continues by describing the use of tests after 1907:

Then followed a period of very rapid development of so-called group tests. Real tests of intelligence began to appear, various tests were tried out and rejected, promising parts of inadequate tests were combined to form new tests. It was a period of testing of tests, formulating, arranging, scoring, weighting, comparing, developing technique, correlating with grades and with other tests. Under the cross fire of experimentation, certain types of tests rapidly became truly objective, free from personal opinion and bias, and surprisingly accurate in making cross sections of the intellectual storehouse.

The tests used in 1913 by Calfee [9], at the University of Texas, were card-dealing, card-sorting, alphabet-sorting, and

mirror tests. At Reed College, in 1912-13, Rowland and Lowden used tests which included three tests of attention, three controlled and uncontrolled associations, a list for imagination, a list for linguistic invention, ten logically related incidents for logical memory, and cards for rote memory.

Between fifty and one hundred colleges and universities are giving some sort of psychological examination as part of the administrative procedure. With some of these institutions this procedure is largely experimental. Some institutions are using psychological examinations as a partial means of selection of entrance candidates, and others are using them for purposes of classification of their students after entrance.

The psychological examination as a means of personnel classification in colleges and universities dates from the close of the world war. Group intelligence tests had their origin in the construction of the Army Alpha test of intelligence by a committee appointed by the American Psychological Association and the National Research Council in April, 1917. This group of psychologists met at Vineland, New Jersey, to produce a test which would separate the drafted men into groups. At the close of the war, colleges were able to procure these tests at a comparatively low cost, and thus the use of psychological examinations in colleges had a special impetus.

The Army Alpha tests possessed the advantages of having been devised with special reference to adults and of having been applied to more than one and three-fourths million men. Consequently, the test results have reached a high degree of standardization. The disadvantages of exclusive use of the Army Alpha test are cited by Whipple [79]. Widespread use of the test makes it possible for students to purchase copies and be coached preparatory to entrance to college. The test was designed for men; women have, therefore, been at a disadvantage. It has also been found, in many cases, to be too easy for college students.

A variety of intelligence examinations, many of them modeled chiefly upon the Army Alpha test, are now in use. Toops [74] sent a questionnaire to 110 colleges and universities. From the results he reported that the Thorndike College Entrance Examination was used most widely in 1923-24. The Otis, Thurstone, and Army Alpha tests were used in decreasing numbers in the order in which they are cited. Tests constructed by indi-

vidual colleges for local use have also been used since the rapid growth of the college group-testing movement.

In order to justify the use of psychological examinations in colleges or universities, we must have some basis for knowing how accurately they can predict success in the institution. The question then immediately arises, success in what? What is academic success? May [49] has said:

In general, it is intellectual achievement, leadership in student affairs, development of a proper view of life, choosing a vocation, building character, etc.

The first, intellectual achievement, is generally considered the most important definition of academic success. It is usually measured by college grades and, occasionally, by instructors' estimates of the students. College grades, however, cannot, as yet, measure any factors in academic success other than intellectual achievement with any degree of accuracy.

The success of predictive measures of grades is usually stated in terms of a coefficient of correlation. The results obtained in the administration of group intelligence tests to students in colleges and universities show a positive relation of intelligence scores to academic achievement as measured by grades, the median correlation being approximately a Pearson coefficient of .45. The intelligence tests have, on the whole, shown more reliability in predicting success than have previous school marks. Colvin and MacPhail [15] said of the value of psychological tests at Brown University:

President Scott emphasizes the value of these tests for prospective freshmen. He considers mental alertness a highly valuable characteristic of college students and asserts that the agreement between the grade received in mental alertness tests and the grade received during the later semesters in college is more complete than the agreement with any other procurable single factor.

The need for better counseling its students has, for some time, been felt at Teachers College, Columbia University. With the increase in enrollment there has come an increase in the number of courses and in the size of classes. The former increase necessitates guidance of the students, if they are to derive the greatest amount of profit from their courses. Since students come from all parts of the country and possess varied kinds and amounts of

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experience, the problem of intelligent counseling is not an easy one.

The graduate school at Teachers College is increasing more rapidly than the undergraduate school. The number of graduate students enrolled since 1918 has increased four times, whereas the total enrollment has been only tripled. Most of the graduate students remain for only a year. Since the classes are large, instructors have the particularly difficult, in fact almost impossible, task of attempting early in the year to meet the needs of the individual students without having much information about them. For this reason the Dean of Teachers College asked the department of Psychology to devise General Examinations. These examinations have been administered to the student body since October, 1927. The first examinations included an intelligence test, two reading tests, a vocabulary test, an interest rating scale, an educational judgment test, and a test devised to test past educational reading.

The problem of this study is to discover the value of the first four tests in predicting academic success as measured by grades. Chapter II summarizes the relationships found between psychological examinations and grades in over fifty colleges and universities in this country. Probable reasons for discrepancies between results on the psychological tests and academic achievement, differences among departments in this institution, a study of age groups, a study of differences between candidates for Master's and for Doctor's degrees, and a study of sex differences will be discussed in later chapters.

CHAPTER II

PSYCHOLOGICAL EXAMINATIONS AS PREDICTIVE MEASURES

The value of psychological tests in educational guidance can best be ascertained by observing how accurately they predict what a student is likely to do in college. With a knowledge of the probable success or failure of a student, advisers can then proceed to attempt an adjustment of the student to his educational environment.

The first attempt to use psychological tests for predictive purposes was made by Wissler in 1901. He found an average correlation of .09 for the tests Cattell used and college grades. Although these early tests proved of negligible prognostic value for anticipating scholastic standing of college students, they represent an early interest in tests for purposes of guidance of college students.

That tests were becoming of increasing prognostic value from 1912 to 1918 is evident by the higher correlations between college grades and test results. Table I shows correlations ranging from .21 to .65, averaging approximately .40.

The average predictive value of psychological tests increased after the advent of standardized group tests in 1918. Toops [74] reported in 1925 a median correlation of .46 between test and grades for 43 colleges and added that there was a direct relation between length of test and size of the correlation. Thurstone [72] reported in 1927 an average correlation of .45 between Thurstone Intelligence tests and freshman scholarship for 26 colleges.

Table II lists more than fifty institutions that have reported correlations between psychological tests and grades since 1918, indicating wherever possible:

1. Reference number in bibliography.
2. Institution making the study.
3. Psychological test used.

TABLE I
CORRELATION BETWEEN PSYCHOLOGICAL TESTS AND ACADEMIC GRADES FROM 1912 to 1918

REFERENCE NO. IN BIBLIOG- RAPHY	INSTITUTION	AUTHOR	TEST USED	SEMESTER	GROUP TESTED	DATE OF TESTING	COEFFICIENT OF CORRELATION	NO. OF CASES
10, 47, 53	Barnard College	Carothers	Special	1, 2	Freshman	1915-19	Average .21 .14 to .27	
47, 53, 77	Beloit College	Waugh	7 Tests		Freshman	1912	Average .41 .24 to .54	
42, 47, 53, 70	University of Chicago	Kitson	16 Tests	1, 2	Freshman, Sophomore, Junior	1914	.44	40
40, 53	University of Iowa	King	Special	Instr. Ranks	Junior Class in Mechanics		.17 to .35	21
41, 53	University of Iowa	King and McCroxy	7 Tests			1916	Average .38 .14 to .84	544
27, 47, 53	Medical School, University of Minnesota	Haggerty	Special	1, 2	First Year	1916	.65	69
53, 75	Northwestern University	Uhl	4 Tests	Mathematics English	Freshman	1916	.41 .46	100
8, 47, 53, 70	Randolph-Macon College	Caldwell	Stanford Binet	All	Junior and Sophomore	1916-17	.44	48
47, 53, 59	Reed College	Rowland and Lowden	Special	1	Mathematics and English Classes	1912-13	.37	54
9, 10, 47, 53	University of Texas	Calfee	4 Tests	1	Freshman	1913	Average .23 .16 to .32	103
10, 53	University of Texas	Bell	9 Tests		Freshman	1913-14	— to .31	750
47, 70, 79	University of Wyoming		Stanford Binet	1	Psychology Class	1916	.53	64

4. Semester or semesters in which average grades were computed.
5. Group within the institution tested.
6. Date of testing.
7. Coefficient of correlation between tests and grades.
8. Number of cases used in computing the coefficient of correlation.

In some cases the date of testing is only approximate; when the class year was the only date reported, it has been assumed that testing was done in the fall of the freshman year. The number of cases reported may in some instances be the number actually tested rather than the number used in computing the correlation; the distinction was often not made.

Calculations based upon Table II show a mean correlation of approximately .48 between first semester marks and the Army Alpha, Thorndike, Thurstone, Otis, and Terman intelligence tests. The relationship between the average of the first and second semesters' grades and these tests is about the same.

The problem of what standardized intelligence tests will best predict college marks cannot be answered with any degree of reliability from the table. Mean correlations between first semester's grades and Army Alpha, Thorndike, Thurstone, and Otis tests are respectively .49, .49, .42, and .49. With the average of the first and second semesters' grades the mean correlations are respectively .42 (excluding 3 correlations from William Smith College for Women), .50, .50, and .47. William Smith College for Women, however, reported correlations from .18 to .33 between average grades for both semesters and the Army Alpha test which may indicate the inadequacy of this test for women or some peculiarity in the college's methods of grading.

Ruch [55] has suggested that the "best measures of prediction should involve batteries of tests of both general ability and past educational achievement." Special tests devised by colleges for local use sometimes involve batteries of tests and often include academic tests with intelligence tests. The University of Iowa battery includes the Thorndike College Entrance Examination, the Thorndike Reading Test, and the Iowa High School Content Examination. The correlation between the Iowa test and grades for one semester was reported as .60. Correlations between academic grades and special college tests follow: Brown University

TABLE II
CORRELATION BETWEEN PSYCHOLOGICAL TESTS AND ACADEMIC GRADES SINCE 1918

REFERENCE NO. IN BIBLIOGRAPHY	INSTITUTION	TEST USED	SEMESTER IN WHICH GRADES WERE OBTAINED	GROUP TESTED	DATE OF TESTING	COEFFICIENT OF CORRELATION	NO. OF CASES
48	Aberdeen State Teachers College	Stanford Binet Stanford Binet	1 1	Pre-normal Junior and Sophomore	1923 1923	.80 .79	
72	Antioch College	Thurstone	1, 2	Upper Classmen	1924	.39	315
47, 59, 70	University of Arkansas	Army Alpha	1, 2	Freshman		.42 to .65	
47	College of Business Administration, Boston University	Boston University				.64	
1, 7, 13, 15, 53, 59	Brown University	Army Alpha	1	Freshman	1919	.44	200
1, 7		Army Alpha	2	Freshman	1919	.39	200
1, 7, 13, 15, 70		Army Alpha	1, 2	Freshman	1919	.46	200
14, 15		Brown University	1	Freshman	1919	.53	200
14, 15, 70		Brown University	1, 2	Freshman	1919	.60	200
15, 59, 70, 79		Brown University	1	Freshman	1920	.46	
15, 59, 70, 79		Thorndike	1, 2	Freshman	1920	.53	
15, 47		Brown and Thorndike	1, 2	Freshman	1920	.36	
15		Thorndike	1, 2	Freshman	1920	.37	
15		Brown	1, 2	Freshman	1920	.34	

TABLE II—(Continued)

15	University of California Carnegie Institution of Technology	Brown	1, 2	Freshman	1921	.41	273
15		Thorndike	1, 2	Freshman	1921	.37	
15		Brown and Thorndike	1, 2	Freshman	1921	.42	
15		Brown	1	Freshman	1922	.38	
15		Thorndike	1	Freshman	1922	.41	
15		Brown and Thorndike	1	Freshman	1922	.46	
13		Alpha and Brown				.52	
15		Army Alpha	1, 2, 3, 4	Class of 1922		.46	
15		Brown	1, 2, 3, 4	Class of 1922		.50	
15		Brown	1, 2, 3, 4, 5, 6	Class of 1922		.45	
15	University of Chicago School of Business, University of Chicago	Thorndike and Brown	1, 2, 3, 4	Class of 1923		.38	111
47, 53		Thorndike	1	Freshman		.47	
47, 79		Army Alpha		Freshman		.34	
47		Thurstone	1	Freshman		.37	
47, 70, 79		Special	Instructors Estimates			.60	
47, 70		Thorndike	1, 2			.41	
31		Army Alpha	1, 2	Freshman	1921	.51	
31		Otis Self-Ad- ministering Test, Higher Examination	1, 2	Freshman	1922	.42	

TABLE II—(Continued)

REFERENCE NO. IN BIBLIOG- RAPHY	INSTITUTION	TEST USED	SEMESTER IN WHICH GRADES WERE OBTAINED	GROUP TESTED	DATE OF TESTING	COEFFICIENT OF CORRELATION	NO. OF CASES
31	Columbia University	Otis Self-Administering Test Higher Examination	1, 2	Freshman	1923	.49	102
31		Terman	1, 2	Freshman	1923	.51	102
31		American Council	1, 2	Freshman	1924	.55	80
84		Thorndike	Average Grade 1, 2	Freshman	1919	.58	
84		Thorndike	Average Grade 1, 2	Sophomore	1919	.59	
84		Thorndike	Average Grade 1, 2	Freshman and Sophomore	1919	.62	111
53, 84		Thorndike	Scholarship Score 1, 2	Freshman	1919	.63	
53, 84		Thorndike	Scholarship Score 1, 2	Sophomore	1919	.62	
53, 84		Thorndike	Scholarship Score 1, 2	Freshman and Sophomore	1919	.67	111
57, 59 57		Thorndike	1	Freshman	1920	.59	
66	Teachers College, Columbia University	Thorndike	1, 2	Freshman	1920	.65	
	Connecticut College	Thorndike	1, 2	Graduate	1926	.45 to .54	
72	Cornell University	Thurstone		Freshman	1924	.36	147
47, 57		Thurstone			1920	.31	

TABLE II—(Continued)

47, 57 10, 47, 67	Dartmouth College	Terman Army Alpha	All	Student Army Training Corps	1920 1918	.44 .44	677
53, 59, 68		Army Alpha	1	Freshman	1919	.44	633
53, 68		Army Alpha	2	Freshman	1919	.33	633
53, 68		Army Alpha	1	Freshman	1920	.50	622
31		Army Alpha	4	Freshman	1919	.43	143
31, 47, 79	De Pauw University Evanston * Goucher College	Judges Estimates					
		Completion of Definitions	1	Freshman	1919	.55	577
12		Thurstone	1	Freshman	1920	.52	
47, 70		Thurstone	1			.29	650
53, 63		Thorndike Men- tal Alertness	All	Senior	1919	.43	98
53, 63		Thorndike Men- tal Alertness	1, 2	Freshman	1919	.40	182
53, 63		Rogers	All	Senior	1919	.20 to .36	98
53, 63		Rogers	1, 2	Freshman		.12 to .41	182
57		Thorndike			1920	.61	
57		Thurstone			1920	.26	
57	Hamline University	Thorndike			1920	.67	
1, 10, 47, 59, 70, 76		Army Alpha	1	Freshman	1918	.47	145
46		Army Alpha	1, 2	Freshman	1919	.32	
46		Army Alpha	1, 2	Freshman	1920	.26	
46		Army Alpha	1, 2	Freshman	1921	.50	
46	Hobart College	Army Alpha	1, 2	Freshman	1922	.35	

* Probably Northwestern University.

TABLE II—(Continued)

REFERENCE No. IN BIBLIOG- RAPHY	INSTITUTION	TEST USED	SEMESTER IN WHICH GRADES WERE OBTAINED	GROUP TESTED	DATE OF TESTING	COEFFICIENT OF CORRELATION	NO. OF CASES
47	Hood College	Terman				.48	
47		Rogers				.34	
47		{ Otis Terman Thurstone Rogers }				.45	
47, 59	Illinois State Normal University of Illinois	Army Alpha	2			.48	379
47, 70		Army Alpha				.37	198
47		Thurstone				.48	
47		Illinois University				.57	
61, 62	University of Iowa	{ Thorndike Reading Iowa High School Content }	1	High School Graduate	1923	.60	1500
		{ Thorndike Reading Iowa High School Content }					
64		{ Thorndike Reading Iowa High School Content }				.54	
54	Harvard University	Thorndike	First Quarter	Freshman		.41	
69	University of Hawaii Kalamazoo College	Thorndike	1	Freshman	1922	.41	212
72		Thurstone	1	Freshman	1924	.43	

TABLE II—(Continued)

72	Marietta College	Thurstone	1	Freshman	1924	.70	100
72	Michigan State Normal	Thurstone		Freshman	1924	.58	84
33, 47, 53, 70	University of Minnesota	Army Alpha	1, 2	Sophomore	1919	.50	84
35, 47, 53		Army Alpha	1, 2	Sophomore	1917	.46	306
47, 65	Montana State University	Special	1, 2	Freshman	1919	.36	306
47, 65		Thorndike	1, 2	Freshman	1919	.46	584
5	Missouri State Teachers College	Army Alpha	Course in Psychology		1919-20	.37	
72	College of Engineering, New York University	Thurstone	1	Freshman	1924	.31	81
4, 7, 53, 79	Ohio State University	Army Alpha	All	All	1919	.35	436
4, 7, 53, 79			All	Sophomore	1919-20-21	.29	100
4, 7, 53, 79			All	Junior	1919-20-21	.29	100
4, 7, 53, 79			All	Senior	1919-20-21	.35	100
4, 7, 53, 79			All	Graduate	1919-20-21	.15	36
4		Thurstone	1	Freshman		.41	
7	Ohio State University	Army Alpha		All		.54	70
7	School of Agriculture			All		.27	106
7	School of Arts	Army Alpha		All		.22	87
7	School of Engineering	Army Alpha		Senior		.39	132
7	School of Agriculture			Senior		.35	81
7	School of Arts			Senior		.25	135
7	School of Engineering			Senior		.52	66
7	School of Education			Freshman	1925-26	.48	80
26	Ohio University	Otis	1	Freshman	1925-26	.40	80
26		Otis	2	Freshman			

TABLE II--(Continued)

REFERENCE NO. IN BIBLIOG- RAPHY	INSTITUTION	TEST USED	SEMESTER IN WHICH GRADES WERE OBTAINED	GROUP TESTED	DATE OF TESTING	COEFFICIENT OF CORRELATION	NO. OF CASES
26	Ohio State Agriculture College	Otis	1, 2	Freshman	1925-26	.49	80
26		Ohio College As- sociation Test	1	Freshman	1925-26	.45	80
26		Ohio College As- sociation Test	2	Freshman	1925-26	.44	80
26		Ohio College As- sociation Test	1, 2	Freshman	1925-26	.47	80
26		Terman	1	Freshman	1925-26	.49	80
26		Terman	2	Freshman	1925-26	.48	80
26		Terman	1, 2	Freshman	1925-26	.52	80
72		Thurstone		Freshman in Course in Electricity	1924	.31	
47, 70	University of Oregon	Army Alpha.	1			.49	71
83		Otis Intermedi- ate Scale	1	Freshman	1923-24	.39	250
47, 53, 70, 79	Pennsylvania State College	Army Alpha.	1	Freshman	1919	.41	320
47		Thurstone				.32	
47	University of Rochester	Stanford Binet				.17	
47, 79		Army Alpha		Freshman	1919-20	.30	550
72		Thurstone		Senior	1924	.43	30
47, 57	Rutgers University	Thorndike			1920	.45	
47		Special	English	All	1920	.50	287
47		Rogers	1	Freshman	1920	.40	87
57	Smith College	Special			1920	.40	

TABLE II—(Continued)

1, 7, 47, 59, 70, 76, 79	Southern Methodist University	Army Alpha	1	All		.52	159
47, 70	Stanford University	Terman	First Quarter			.54	63
47, 70		Terman	All	Sophomore, Junior, Senior		.42	59
47, 70		Stanford Binet	All	Sophomore, Junior, Senior		.42	42
47, 70		Stanford Binet	1, 2	Freshman		.46	91
17, 47, 70		Army Alpha	All	History Classes	1920-21	.43	94
47, 59, 70		Army Alpha	All	Student Army Training Corps		.31	313
47	Syracuse University	Army Alpha				.20 to .40	
51	Sweet Briar College	Thurstone	1, 2	Freshman	1919	.43	
51		Thurstone	1, 2	All	1921	.52	450
72	Transylvania College	Thurstone	1	Freshman	1924	.39	100
47, 70	Vassar College	Thurstone	1, 2	Freshman		.33	278
72	Vanderbilt University	Thurstone	1, 2	Freshman	1924	.62	240
72	University of Virginia	Thurstone	1	Freshman	1924	.57	391
47, 83	Washington University	Army Alpha	1	Psychology Class	1921	.52	348
47, 83		Army Alpha	1	Psychology Class	1922	.71	85
3	Worcester State Normal School	Otis	1	Freshman	1919	.61	59
3		Thurstone	1	Freshman	1919	.38	59
46	William Smith College	Army Alpha	1, 2	Freshman	1920	.22	
46		Army Alpha	1, 2	Freshman	1921	.33	
46		Army Alpha	1, 2	Freshman	1922	.18	
18, 47	University of Wyoming	Thorndike	1	Freshman	1918	.40	70

TABLE II—(Continued)

REFERENCE NO. IN BIBLIOG- RAPHY	INSTITUTION	TEST USED	SEMESTER IN WHICH GRADES WERE OBTAINED	GROUP TESTED	DATE OF TESTING	COEFFICIENT OF CORRELATION	NO. OF CASES
72	Wilson College	Thurstone	1, 2		1924	.60	
72	College of Wooster	Thurstone	1		1924	.52	270
1, 47, 59, 70, 79	Yale University	Army Alpha	1	Freshman	1919	.38	373
47, 57		Yale Examina- tion Special			1920	.50	
70		Thurstone		Freshman	1924	.42	85
72	Twenty-six Colleges (Thurstone)					.45	
74	Forty-three Colleges (Toops)					.46	

Test, mean $r = .45$; Dartmouth Completion of Definitions Test, $r = .55$; Illinois University Test $r = .57$; Ohio College Association Test, $r = .45$; Smith College Test, $r = .40$; Yale University Examination $r = .50$.

Kornhauser [43], of the University of Chicago School of Business, reported that the correlations with first-year scholarship are closest for reading comprehension tests, intelligence tests being next, and high school averages last. He added that of the four intelligence tests used, Army Alpha, Otis, Terman, and American Council, no one of these appeared markedly superior to the others. In the lower ranges of ability, however, he found that intelligence tests have the best prognostic value. Test correlations decrease when the correlations with college marks beyond the first year are considered.

Guiler [26], in reporting on the value of group tests at Ohio University, concluded that certain types of material, such as analogies, arithmetic, number series, reading, and word meaning, seem to have most predictive value of academic achievement.

A table of about sixty correlations between psychological scores and academic grades in various colleges and universities was constructed by MacPhail [47]. He found a central tendency of the coefficients of from .40 to .45.

Johnston [34] reported on the use of psychological tests at the University of Minnesota:

The psychological tests used have been much the same type since 1921, when they came into the hands of Professor Paterson. They have been revised from year to year. When some part of the test was found to have little or no significance, we rejected that and put in something else. We have now a test which correlates well with college work. We are not testing general intelligence, we are testing the probability of a student's performing as we want him to perform in college.

Of 1,088 students who entered in 1923, 1924, and 1925, and whose combined ratings were studied, it was predicted that 208 (who were listed individually by name in advance) would be unable to show satisfactory scholarship in college. Of these 208, only 3 exceeded our expectations.

In presenting these results it is necessary to explain that neither administrators nor psychologists claim that psychological tests are the only means of predicting academic success. In graduate teacher-training institutions they are, at present, the most easily administered and easily scored examinations, and

they are more practical and reliable than previous school records. Consequently, psychological tests are probably the best single measures of prediction of academic success in graduate teachers' colleges.

The correlations between test scores and college marks will never be perfect. One of the reasons for this is the fact that marks, the most common measure of academic success, are inaccurate. Guiler [26] reported a reliability coefficient of .69 between grades of the first semester and grades of the second semester at Ohio University. Shuttleworth [64] reported a correlation of .72 between first semester grade points and second semester grade points at the University of Iowa. Toops [74] found a median correlation of .66 between first and second semesters' grades of 110 colleges that answered a questionnaire. At the University of Chicago School of Business, Kornhauser [43] found a reliability coefficient of from .40 to .70 between marks of the first and second quarters, and of .68 between the first year's average and the second year's average. At Yale University, Anderson and Spencer [2] found reliability coefficients of from .60 to .85. The correlation between grades of graduate students of the first semester and the second semester at Teachers College for 1927-28 was .65. It is evident that reliability coefficients of from .40 to .85 for academic success may have attenuated to a considerable extent the correlations between psychological examinations and college grades.

SUMMARY

A summary of the results of using psychological examinations as predictive measures of academic success follows:

1. The average correlation between tests used in 1901 and college grades was .09.
2. The average correlation between tests used from 1912 to 1918 and college grades was about .40.
3. The average correlation between tests used since 1918 and college grades was between .43 and .48.
4. There is no significant difference among the standardized tests used, in so far as the prediction of academic success is concerned.
5. Tests devised by colleges for local use predict academic success better, on the whole, than do standardized tests. This

may be due to the fact that batteries of tests are often used, in some cases including measures of past achievement.

6. Correlations between psychological tests and academic success are attenuated by the unreliability of school marks. The reliability coefficients of the latter range from .40 to .85.

CHAPTER III

DESCRIPTION OF DATA AND METHODS

The data used in this study were obtained from the General Examination given for the first time to students in Teachers College in October, 1927. It has since been administered during two three-hour periods at the beginning of each session, in October, February, and July of each year. All students working for a degree are required to take the examination.

Results of four of the seven tests administered during the first period were studied in this investigation. These tests were: Part I—Thorndike Test; Part III—Thorndike Test; Part IV—a Reading Test; and Part VII—a Vocabulary Test.

Part I is a test of general intelligence and includes ten tests of directions, arithmetical operations, arithmetical reasoning, information, synonyms, vocabulary, judgment, and completion of equations. Part III is a reading test containing eight paragraphs. Probable answers are suggested, and the student checks the correct answer.

Part IV is another reading test, and Part VII a vocabulary test, both devised at Teachers College. The reading test consisted of eight paragraphs with six questions about each paragraph. The student wrote the answers after each question. The vocabulary test contained 100 words with five multiple choice responses following each word. The number of the correct synonym was placed in the margin opposite the proper word.

Since the most acute problem at present is that of advising graduate students, it was this group only that was studied. Students carrying less than eight points the first semester, as well as foreign students, were excluded. The total number of English-speaking graduate students carrying eight or more points the first semester, who took the General Examination in October, 1927, was 840.

The scores made on the separate parts of the General Examination were converted into T scores. A distribution of the raw

scores of each test showed that they distributed themselves somewhat according to the normal curve. Frequency distributions of the scores, for the entire group tested, of the four parts used in this study are found in Table III.

The plan of converting raw scores into T scores (a special form of the well-known standard measures) was devised by

TABLE III

DISTRIBUTIONS OF SCORES FOR TESTS USED IN THE GENERAL EXAMINATION,
OCTOBER, 1927

PART I THORNDIKE TEST		PART III THORNDIKE READ- ING TEST		PART IV READING TEST		PART VII VOCABULARY TEST	
Score	Fre- quency	Score	Fre- quency	Score	Fre- quency	Score	Fre- quency
0-9 ..	1	0-9 .	1	0-4 .	2	0-4 ...	1
10-19 ..	0	10-19 .	1	5-9 .	0	5-9 ...	2
20-29 ..	4	20-29 .	8	10-14 .	5	10-14 ...	10
30-39 ..	9	30-39 .	8	15-19 .	2	15-19 ...	38
40-49 ..	24	40-49 .	17	20-24 .	2	20-24 ...	76
50-59 ..	47	50-59 .	22	25-29 .	4	25-29 ...	137
60-69 ..	68	60-69 .	48	30-34 .	10	30-34 ...	276
70-79 ..	144	70-79 .	71	35-39 .	16	35-39 ...	350
80-89 ..	164	80-89 .	135	40-44 .	19	40-44 ...	365
90-99 ..	205	90-99 .	170	45-49 .	39	45-49 ...	406
100-109 ..	254	100-109 .	213	50-54 .	50	50-54 ...	360
110-119 ..	342	110-119 .	260	55-59 .	57	55-59 ...	255
120-129 ..	327	120-129 .	262	60-64 .	69	60-64 ...	187
130-139 ..	305	130-139 .	279	65-69 .	91	65-69 ...	112
140-149 ..	246	140-149 .	239	70-74 .	145	70-74 ...	97
150-159 ..	217	150-159 .	241	75-79 .	170	75-79 ...	60
160-169 ..	164	160-169 .	191	80-84 .	201	80-84 ...	28
170-179 ..	89	170-179 .	176	85-89 .	233	85-89 ...	13
180-189 ..	81	180-189 .	168	90-94 .	269	90-94 ...	2
190-199 ..	53	190-199 .	107	95-99 .	275		
200-209 ..	29	200-209 .	71	100-104 .	301		
210-219 ..	9	210-219 .	52	105-109 .	271		
220-229 ..	7	220-229 .	38	110-114 .	224		
230-239 ..	3	230-239 .	10	115-119 .	143		
		240-249 .	4	120-124 .	103		
		250-259 .	2	125-129 .	39		
		260-269 .	1	130-134 .	17		
				135-139 .	1		
Total	2,792		2,795		2,758		2,755
$Q_1 = 101$		$Q_1 = 110$		$Q_1 = 80$		$Q_1 = 37$	
Med. = 124		Med. = 137		Med. = 95		Med. = 47	
$Q_3 = 148$		$Q_3 = 166$		$Q_3 = 107$		$Q_3 = 56$	

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McCall [50] and is described by Spence [66]. Weights are assigned to the scores on the basis of their S. D. position.

The base line from -5 S.D. units to $+5$ S.D. units is divided into 100 units, and the point -5 S.D. is used as a zero point. An average score then becomes 50, and for ordinary classes the values will fall largely between 25 and 75. The method based upon S. D. measures is used in preference to others because it gives a scale in which the units are equal and comparable. The difference between 29 and 30 is equal to a difference between 51 and 52 and between 73 and 74.

The method of computing T scores is described by McCall [50]:

1. Compute the number receiving each group of scores—the frequency.
2. Compute the number exceeding plus one-half just reaching each score. Thus an average value for each step interval is computed.
3. Compute the per cent exceeding plus one-half just reaching by dividing the number derived in step 2 by the total number of cases.
4. Convert the percentiles into S. D. values or T-scale scores by the use of Table 23 in McCall's book [50].

The computation for T-scaling the Thorndike Test (Part I) is found in Table IV of this study.

Table IV shows that the midpoint of the group of scores from 0-9 has a T score value of 14.5; the midpoint of the interval from 10-19 has a T score value of 16.5, etc. Since each student's score is to be assigned a T score value, it is then necessary to interpolate values from 14.5 and 16.5 and from 16.5 to 19.5, etc., for individual scores. The assumption is made that the scores distribute themselves evenly throughout each interval. Consequently, scores from 0-6 are assigned a T score value of 14; scores from 7-12 have a value of 15, etc. The final complete T tables are given in the Appendix.

An average T score was computed from the T scores for the four parts of the General Examination: Part I—Thorndike Test; Part III—Thorndike Test; Part IV—a Reading Test; Part VII—a Vocabulary Test.

Academic achievement was defined as average grades for each session, winter and spring, 1927-28. Several methods for assigning weights to different grades have been proposed. The most

TABLE IV
METHOD OF T-SCALING SCORES ON THORNDIKE TEST (PART I)

SCORE	FREQUENCY	NUMBER EXCEEDING PLUS HALF JUST REACHING	PER CENT EXCEEDING PLUS HALF JUST REACHING	T SCORE
0-9	1	2791.5	99.98	14.5
10-19	0	2791	99.96	16.5
20-29	4	2789	99.89	19.5
30-39	9	2782.5	99.65	23
40-49	24	2766	99.06	26.5
50-59	47	2730.5	97.79	30
60-69	68	2673	95.73	33
70-79	144	2567	91.94	36
80-89	164	2413	86.42	39
90-99	205	2228.5	79.81	41.5
100-109	254	1999	71.59	44.5
110-119	342	1701	60.92	47
120-129	327	1366.5	48.94	50.5
130-139	305	1050.5	37.62	53
140-149	246	775	27.75	56
150-159	217	543.5	19.44	58.5
160-169	164	353	12.28	61.5
170-179	89	226.5	8.11	64
180-189	81	141.5	5.06	66.5
190-199	53	74.5	2.66	69.5
200-209	29	33.5	1.19	72.5
210-219	9	14.5	.51	76
220-229	7	6.5	.23	78.5
230-239	3	1.5	.05	83

common method is that of assigning an arbitrary numerical value to the grades, viz., $A = 4$, $B = 3$, $C = 2$, $D = 1$, $F = 0$, and dividing by the total number of points carried. This method assumes that the difference between A and B is equal to the difference between D and F and that all courses are of equal difficulty. It also does not differentiate between the student who is carrying a heavy load and one who is carrying an unusually light load.

Wood [84] used the "scholarship score," which is the sum of the products of semester hours by grades for all hours of college work attempted. The numerical values assigned to letter grades F, D, C, B, A are respectively 1, 4, 6, 8, 11 for one semester. Thus an assumption that the gap between A and B is the same as that between D and F is made. The method is probably more feasible in an undergraduate institution than in

a graduate school, since practically all the students in the former are full-time students and are expected to carry somewhat similar loads. In a graduate school, too, the proportion of failures is less since its students are more mature and responsible. Consequently, the gap between D and F is probably greater than between A and B.

Spence [66] suggested two methods for assigning weights to grades. In one method he made an attempt to equalize the difference between the percentages of various grades given by various instructors. He assumed, moreover, "that the distribution of ability within each class would tend to be, in general, somewhat near the normal curve" and that all classes in the college were of equal difficulty. "Weights were assigned to the various grades on the basis of their S. D. position." In other words, the grades were assigned T score values, each class being T-scaled separately. In the second method there is a "scheme in which each grade is given a value, and this value is then used regardless of the class from which the student may get his grade. This average value is computed by getting the total distribution of grades for all classes and computing the T scores for each grade." This plan may be used for a five-point grading system, A, B, C, D, E, F, or for a system using + and - with each letter grade except F. Spence concludes, from a study of correlations between intelligence test scores and grades weighted by each of the above methods, that the first of his proposed methods is the most valid system.

For the first semester the first method suggested by Spence was followed. Each class containing twenty or more students was T-scaled, according to the method described in McCall [50]. Table V gives an illustration.

Students who received grades of "Incomplete" or "Withdrawn" were not included in the T-scaling, although some of these would undoubtedly have received grades of D or F. A T table and a percentage table given by Spence [66], Appendix III, pages 85-89, facilitated the computation of finding the "per cent exceeding plus one-half just reaching" and the final T scores.

Variations in the per cent of various letter grades given in different classes can be seen from Table VI, which is composed of T scores for the letter grades of ten classes of 100 or more students each in the School of Education.

TABLE V
METHOD OF WEIGHTING GRADES BY T-SCALING

GRADE	FREQUENCY	NUMBER EXCEEDING PLUS HALF JUST REACHING	PER CENT EXCEEDING PLUS HALF JUST REACHING	T SCORE
A + ...	1	0.5	0.33	74
A	4	3	2	71
A -	12	11	7	65
B + ...	23	28.5	19	59
B	27	53.5	36	54
B -	28	81	54	49
C + ...	24	107	72	44
C	13	125.5	84	40
C -	12	138	92	36
D + ...	0	...	..	..
D	3	145.5	97	31
D -	0		..	..
F	3	148.5	99	27

TABLE VI
T SCORES FOR LETTER GRADES OF TEN CLASSES IN EDUCATION

CLASS	NO. IN CLASS	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
1	150	74	71	65	59	54	49	44	40	36		31		27
2	130		74	73	69	65	60	56	49	40		34		
3	151	73	66	64	61	57	53	48	44	38		27		
4	116		73	69	65	61	56	51	45	39	32	27		
5	158	73	66	61	59	53	48	45	40	35		31	29	27
6	170		74	66	61	55	49	45	40	34	31	27	26	
7	108		66		59	54	51	48	45	40		34	27	
8	163	73	66	62	59	55	50	47	40	29		27		
9	109	68	61	58	56	53	49	46	40	31				
10	101	73	64	60	56	52	48	46	43	36		27		

TABLE VII
T SCORES FOR LETTER GRADES OF TEN CLASSES NOT IN EDUCATION

CLASS	NO. IN CLASS	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
11	67			73	66	61	57	54	48	39		27		
12	85			66	60	55	50	46	40	27				
13	119	74	69		62	60	57	52	48	41		31	27	
14	106		71	66	62	58	52	45	41	37		32		27
15	77		71	66	62	58	55	52	46	40		34		29
16	66	68	58	53	52	47	42	41	36					
17	85		68	63	59	54	48	40	32					27
18	149	66	59	56	52	46	44	40	36	29				
19	76		69	63	59	54	48	43	38	32	27			
20	88		73	71		65	58	51	45	38	27			

Table VII is composed of the T score values for letter grades of the ten largest classes not in the field of education.

Tables VI and VII show that considerable differences in instructors' gradings occur even in large classes. The classes in Education show slightly less variation than those outside of Education. In Education the T score values for A vary from 58 to 74; for B they vary from 48 to 69; for C they vary from 29 to 56; and for D they vary from 26 to 34. In the classes outside of Education the T score variations are as follows: A from 53 to 74; B from 42 to 66; C from 27 to 54; D from 27 to 34; and F from 27 to 29. Taking the 20 classes together, there is a variation of 21 T score values for a letter grade of A; 27 for B; 29 for C; 8 for D; and 2 for F. In other words, in one class a C grade has the same value as F in other classes, while a C grade in one class has the same value as A in another.

A T score table was constructed for each class in the college. In smaller classes the total number of letter grades given by one instructor to two or more classes was included in T-scaling. In a few instances an instructor had a total of less than twenty students in his classes. These letter grades then received an average T score value for all the classes in the college. The same was true of grades received in classes outside of Teachers College, i.e., at Union Theological Seminary, Columbia College, Barnard College. The average T score values for all classes for one semester in Teachers College follow:

A	A—	B+	B	B—	C+	C	C—	D	F
66	62	58	53	49	46	41	35	31	27

Spence [66] found average T score values for one semester's grades as follows:

A	A—	B+	B	B—	C+	C	C—	D	F
67	61	58	53	49	46	41	33	28	21

The letter grades for each class of the second semester were not converted into T score values, but the average values for the first semester were used. Spence [66] found a correlation of .928 between the two methods of weighting grades. This reliability seemed high enough to warrant using the second method since it saved a considerable amount of computation. Moreover, the more thorough study of students is made on the basis of the first semester's results.

The correlation between grades for the first semester, weighted by the T score method, and the second semester for 837 students was $.653 \pm .014$. Only graduate students carrying at least eight semester hours of work the first semester were included. The average number of semester hours of work carried by full-time students is sixteen, the maximum being eighteen, although a few students, may, with special permission from the Director, carry nineteen. Foreign students were excluded. Language handicaps at the beginning of the year when the General Examination was given made it impractical to use their scores.

The relationship between psychological tests and grades is far from perfect. Some reasons for this fact are given by Colvin [14]:

1. Tests are not accurate measures of intelligence.
2. Tests vary in coachability.
3. Qualities other than intelligence contribute to a student's academic career.
4. Marks are inaccurate measures of success.
5. College students are a highly selected group.

The second reason was scarcely a problem with the group studied at Teachers College. The General Examination was given for the first time, and students had no idea of its nature. Two of the tests were constructed for the examination; moreover the Thorndike tests are published in so many forms that the chances of any student's being able to procure the test he was examined on were practically zero.

That marks are not an accurate measure of academic success is evident from the reliability coefficient found for this group for the two semesters. An attempt was made to minimize inaccuracies due to variations in instructors' distribution of marks. Because of this inaccuracy of the trait measured, the correlation between tests and grades will be attenuated considerably.

"College students are a highly selected group." Graduate students are probably an even more highly selected group. At any rate, since graduation from a normal school is the average requirement for teaching throughout the country, only the most ambitious and capable students would take a year's leave of absence or more from their teaching in order to continue work beyond the baccalaureate degree in a teacher-training institution. Since the range of ability is thus limited, the correlation between

tests and grades for this group would be lower than for a group of greater variability.

"Tests are not accurate measures of intelligence." We may omit a discussion of the validity of the psychological tests as measures of intelligence, since the main purpose of this study is to attempt to predict academic success by means of these tests. Nevertheless, the accuracy of the tests when they do measure traits is important for consideration.

Toops [74], as a result of a questionnaire sent to 110 colleges and universities, found that the average coefficient of reliability for intelligence tests was a Pearson coefficient of .87. Colvin [13] found that the reliability of the Brown University Tests for Series I and II was .76. Anderson and Spencer [2] found that the coefficients of reliability between Form I and Form II of the Army Alpha group test were Pearson coefficients ranging from .80 to .85.

Since the tests used in this study could not have been duplicated by giving alternate forms to the same group of students, the coefficients of reliability or self-correlations could not have been computed by correlating alternate forms with each other. Consequently, the reliability of half the tests was measured, and by applying the Spearman-Brown prophecy formula the reliability of the whole test was found. Odd items of each test, i.e., exercises 1, 3, 5, 7, etc., were correlated with even items, i.e., exercises 2, 4, 6, 8, etc. This relationship gives the reliability coefficient of the half test. Since the items chosen were alternate it is safe to make the assumption that the halves of the test were of equal difficulty and content; and, substituting $N = 2$ in Spearman's formula, the reliability of the whole test was found by using the formula,

$$r_{11} = \frac{2r}{1 + r}.$$

The self-correlations of the four parts of the General Examination were as follows:

Part I—Thorndike Test	.885 ± .010
Part III—Thorndike Test	*.891 ± .010
Part IV—Reading Test	.772 ± .027
Part VII—Vocabulary Test	.912 ± .008

* Since each student took but one form, the reliability of this part as given here is the average of the four parts.

Four forms of the Reading Test (Part IV) were given, each to one-fourth of the students. The reliability coefficients of each of the forms follow:

Form A	.775 $\pm$.027
Form B	.757 $\pm$.029
Form C	.783 $\pm$.026
Form D	.771 $\pm$.027

The self-correlations of the four parts, ranging from .77 to .91, are higher than those of the studies reported earlier.

"Qualities other than intelligence contribute to a student's academic career." That this is an important limitation on the value of psychological tests is evident from the fact that no matter how valid and reliable the tests are their relationship with grades is always far from perfect. What these qualities are has been speculated upon by many writers.

Johnston [32] states that "Success in college is determined by mental ability and moral character." In another article [34] he states:

Some of the criteria that may be used to measure student aptitude in advance are content of previous studies, evidence of success in previous work of a nature similar to that of the college, capacity for college work as ascertained by psychological tests, desirable traits of character, physical force, ambition, zeal for study, honesty, and social cultivation.

Johnston [35] lists various character factors not measured by intelligence tests as: "industry, perseverance, determination, driving force, power of concentration, susceptibility to praise, ambition, idealism, and optimism."

The factors on which intellectual achievement depend, according to May [49], are: "intelligence, preparatory school work, industry, mental efficiency, interest, character traits, health, and physical and social environment."

Reese [58] states that "personal and intellectual traits such as attention, perseverance, teachableness, ambition tend to offset any lack in intelligence."

Roberts' [59] list includes: "energy, industry, habits of work, moral character, stability, health conditions, temperament, ideals, earnestness, will-to-win."

Wilbur [81] lists the following traits as influencing academic success: "scholarship, personality (personal strength and at-

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tractiveness), industry (energy, perseverance, application), judgment and common sense, reliability, initiative, coöperation, native ability, leadership, and physical vitality."

Columbia College, according to Wood [84], bases the selection of its entering students on the following traits: "preparation, character and promise, health, and intelligence."

An attempt was made at Teachers College to find out from the students some of the reasons for variations in academic work and average scores on the General Examination. A questionnaire was sent to all students of the group used in this study whose (1) Average T score on the General Examination was ten or more points higher than the average T score value for grades for the first semester; (2) average T score for grades was ten or more points higher than the average T score on the General Examination; (3) average T score for grades varied less than three points from the average T score on the General Examination.

The same form letter was sent to all students asked to fill out the questionnaire so that they would have no indication wherein the variation, if there were any, lay. The letters were sent during the second semester. The number and per cent of students who filled out and returned the questionnaires are as follows:

VARIABLE	NO.	PER CENT
General Examination—Higher	73	74
Grades—Higher	54	61
No Variation	164	74

There were 23 questions, of which the first 13 were concerned with the student's physical condition during the examination and attitude toward this and any examinations. The last 10 questions related to the student's academic work and factors influencing it, such as interest, health, and work for remuneration. It was not expected that the questionnaire method would lend itself to investigating with any degree of reliability any but a very limited number of the traits other than intelligence influencing academic achievement. Attitudes of students toward the General Examination and toward academic work, however, could be ascertained. The results of the questionnaire are given in Chapter V.

It is important, at this stage, to point out that it is not expected that psychological examinations alone will resolve all the difficulties of educational guidance. Factors other than the abilities measured by examinations are very important. Nevertheless, as a starting point, it is of great importance to find out the exact value of examinations for predictive purposes and, consequently, for student guidance.

SUMMARY

A summary of the data and methods used in this investigation follows:

1. The results of the General Examination given in October, 1927, are used in this study.
2. Four of the tests given as part of the General Examination and used in this study are: Thorndike Test (Part I); Thorndike Test (Part III); Reading Test (Part IV); Vocabulary Test (Part VII).
3. The group studied consisted of 840 graduate students, who were taking eight or more semester hours work during the first semester. Foreign students were excluded.
4. The scores of the separate parts of the General Examination were converted into T scores. The average for the four parts is the average General Examination score.
5. Methods of weighting grades in other institutions are given.
6. The grades for the winter session were converted into T score values, each class being T-scaled separately.
7. The grades for the spring session were converted into T score values. Average values for all the classes of the first semester were used.
8. The reliability coefficient of grades for the first and second semesters was .65.
9. The reliabilities of the four parts of the General Examination used in this study and ranging from .77 to .91, are given.
10. The qualities other than intelligence that probably contribute to a student's academic success as listed in several articles are given.
11. A questionnaire was sent to some of the students of the group studied. An attempt was made to find the probable causes of variations in academic achievement and the General Examination.

CHAPTER IV

RELATION BETWEEN GENERAL EXAMINATION AND GRADES

The question that presents itself at this point is: To what extent do ratings obtained on the General Examination predict academic achievement? The relationship between the tests and grades is best expressed by means of a coefficient of correlation.

Table VIII is a correlation table for the students in the group studied showing the relationship between tests and grades:

	AVERAGE GENERAL EXAMINATION T SCORE ($X = \text{VARIABLE}$)																				TOTAL
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
AVERAGE T SCORE GRADES ($Y = \text{VARIABLE}$)																					
19																					
18																					
17																					
16																					
15											1		2	6	2	1	2	1		1	16
14								2	1	1	2	3	2	3	3		1	1			19
13								2	2	3	10	16	14	12	10	5	2	1			77
12							2	4	9	10	11	15	13	12	9	5	6		2		98
11					1	4	7	14	21	21	23	17	12	7	8	2					137
10					4	9	15	14	17	33	23	17	18	6	3	2					161
9					1	7	11	9	16	17	20	23	8	8	8	3	1				132
8					1	2	5	7	23	18	14	13	3	2	5						93
7					4	1	8	10	4	9	11	4	3	1							55
6					1	2	3	8	8	1	5	4	2	1							35
5				1			2	4		1	2		1								12
4			1						1												3
3			1		1																2
2																					
1																					
0																					
TOTAL			2	1	8	18	44	68	92	98	131	124	82	75	50	25	16	3	2	1	840

Along the bottom of Table VIII will be found the number of students in each column for test scores; and along the right hand margin is the total number of students in each row for grade scores.

By means of the data given by the correlation chart the coefficient of correlation was found by the formula:

$$r_{xy} = \frac{\sum xy}{N\sigma_x\sigma_y}$$

where x is the deviation from the true mean of the General Examination and y is the deviation from the true mean of grades.

The standard deviations and means of General Examination scores and academic grades are given in Table IX.

TABLE IX

STANDARD DEVIATIONS AND MEANS OF GENERAL EXAMINATION SCORES AND ACADEMIC GRADES

S. D. AND MEAN	AVERAGE GENERAL EXAMINATION T SCORE	GRADES, FIRST SEMESTER	GRADES, SECOND SEMESTER	AVERAGE GRADES, BOTH SEMESTERS
S.D.	8.136	6.358	5.730	5.463
Mean	51.552	51.145	52.233	51.677

The coefficient of correlation between General Examination scores and grades for the first semester was * .459 $\pm$.018; between General Examination scores and grades for the second semester .442 $\pm$.019; and between General Examination scores and average grades for both semesters .535 $\pm$.017.

Table X (page 36) shows the significance of the correlation of * .46 between test scores and first semester's grades.

The following statements may be made concerning Table X: 40 per cent of those who stood in the highest fifth on tests stood in the highest fifth in academic grades, while only 2 per cent of those who were in the highest fifth on tests were in the lowest fifth academically. Moreover, 5 per cent of those who stood in the bottom fifth psychologically attained academic grades in the highest fifth, while 33 per cent or one-third of those in the bottom fifth psychologically were also in the bottom fifth academically. Of those in the top 20 per cent psychologically practically two-thirds were in the top 40 per cent academically; and two-thirds of those in the bottom 20 per cent psychologically were in the bottom 40 per cent academically. It seems, then, that the varia-

* Correction for attenuation due to the unreliability of both measures would not be appropriate in the practical problem of discovering the relationships among existing measures.

TABLE X
PER CENT OF STUDENTS IN QUINTILE GROUPS OF GRADES

Of Top 20 Per Cent in General Examination:	
41 per cent stood in top 20 per cent of grades.	
25 per cent stood in 2nd 20 per cent of grades.	
18 per cent stood in 3rd 20 per cent of grades.	
15 per cent stood in 4th 20 per cent of grades.	
2 per cent stood in 5th 20 per cent of grades.	
Of Bottom 20 Per Cent in General Examination:	
5 per cent stood in top 20 per cent of grades.	
12 per cent stood in 2nd 20 per cent of grades.	
19 per cent stood in 3rd 20 per cent of grades.	
28 per cent stood in 4th 20 per cent of grades.	
35 per cent stood in 5th 20 per cent of grades.	
Of Top 10 per Cent in General Examination:	
44 per cent stood in 1st 20 per cent of grades.	
29 per cent stood in 2nd 20 per cent of grades.	
13 per cent stood in 3rd 20 per cent of grades.	
12 per cent stood in 4th 20 per cent of grades.	
2 per cent stood in 5th 20 per cent of grades.	
Of Bottom 10 Per Cent in General Examination:	
2 per cent stood in 1st 20 per cent of grades.	
7 per cent stood in 2nd 20 per cent of grades.	
19 per cent stood in 3rd 20 per cent of grades.	
29 per cent stood in 4th 20 per cent of grades.	
43 per cent stood in 5th 20 per cent of grades.	

bility between quintile groups of grades is approximately the same for the higher and lower groups on the General Examination.

Figures I and II illustrate the above statements more clearly.

The quartile groups in the General Examination exhibit a significant variation in the proportion of courses failed or failed on condition (F or D) in Teachers College during the academic year, 1927-28. The per cent of the total number of courses failed follows:

Lowest 25 per cent in the General Examination.....	49 per cent.
Second lowest 25 per cent in General Examination.....	24 per cent.
Second highest 25 per cent in General Examination.....	22 per cent.
Highest 25 per cent in the General Examination.....	5 per cent.

The significance of a coefficient of correlation can be further explained. A coefficient of .46 has a predictive index of .12. Bailor [4] explained the predictive index as a "number which expresses the amount of improvement in prediction which is

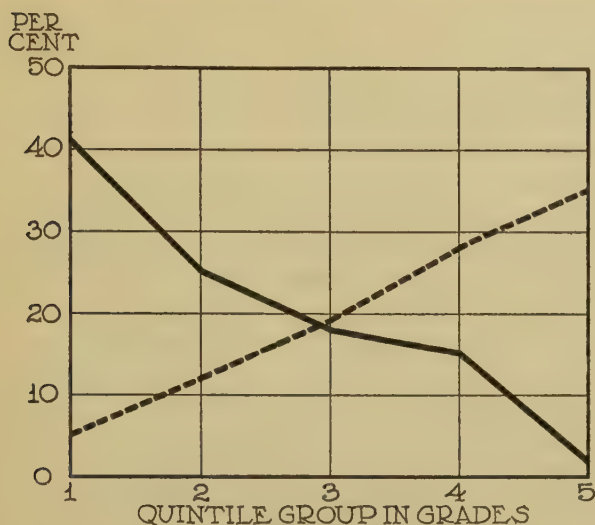


FIGURE I

PER CENT OF STUDENTS IN QUINTILE GROUPS IN GRADES

———— Top 20 per cent in General Examination
 ----- Bottom 20 per cent in General Examination

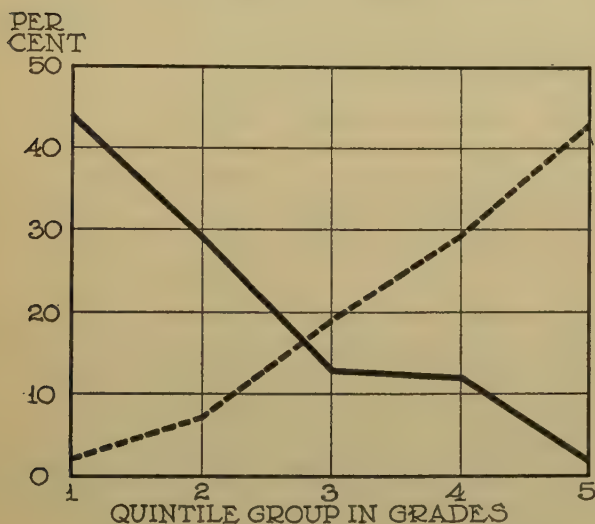


FIGURE II

PER CENT OF STUDENTS IN QUINTILE GROUPS IN GRADES

———— Top 10 per cent in General Examination
 ----- Bottom 10 per cent in General Examination

made possible by means of the correlation which exists between the two traits considered." In other words, the correlation shows that only 12 per cent of the variability in grades is accounted for by changes in the General Examination scores. The other 88 per cent of variability in grades must be due to factors such as the unreliability of grades, study habits, health, etc.

One of the assumptions on which the Pearson r is based is that the relationship between the two variables is rectilinear rather than curvilinear. In other words, if the means of the arrays of each trait fall in a straight line the relation is linear.

A test for linearity was applied by using Blakeman's test for linearity. A formula for this test is given by Holzinger [29], page 183, formula 67. The correlation ratios for the relationship between General Examination (x) and grades (y) are as follows:

$$\eta_{xy} = .481, \text{ and } \eta_{yx} = .473.$$

When Blakeman's test was applied it was found that the differences between η and r were not significant. Consequently, it may be concluded that the relationship between grades and General Examination scores is rectilinear.

A method of predicting an individual's most probable standing in grades (Y), if his average score on the General Examination (X) is known, is given by using the formula:

$$Y = r_{xy} \frac{\sigma_y}{\sigma_x} X + K$$

where K is a constant given by the formula:

$$K = M_y - (M_x) \left(r_{xy} \frac{\sigma_y}{\sigma_x} \right).$$

The regression equation for predicting grades is as follows:

$$Y = .372 X + 31.849$$

where X is the score made on the General Examination and Y is the most probable standing in grades. An assumption made in using this type of regression equation is that the relationship between the two traits is rectilinear. From the calculation above it may be concluded that in the case of the correlation between grades and General Examination scores this is practically true.

In finding the relationship between grades and average Gen-

eral Examination scores, the four parts of the General Examination used are given equal weights. It is highly probable that differences in value for predicting grades exist among the parts. The method for finding if differences exist and to what extent is that of computing the regression equation for predicting the probable standing in grades from known scores in the separate parts of the General Examination.

In order to compute the regression equation it is first necessary to find the relation of grades to each part of the examination. The partial coefficient for correlation shows to what extent each of the parts is related to grades, other things being equal and the other three parts being held constant. The general formulæ for computing partial correlations are to be found in Yule [85].

Table XI shows the first order correlations among the separate parts of the examination and grades.

TABLE XI

CORRELATIONS AMONG SCORES ON PARTS OF THE GENERAL EXAMINATION AND GRADES FOR THE FIRST SEMESTER

	1 GRADES	2 SCORE ON PART I— THORNDIKE TEST	3 SCORE ON PART III— THORNDIKE TEST	4 SCORE ON PART IV— READING TEST	5 SCORE ON PART VII— VOCABULARY TEST
1. Grades		.356 ± .020	.412 ± .019	.387 ± .020	.398 ± .020
2. Score on Part I— Thorndike Test .			.648 ± .014	.564 ± .016	.552 ± .016
3. Score on Part III— Thorndike Test .				.645 ± .014	.579 ± .016
4. Score on Part IV— Reading Test...					.516 ± .017
S. D.	6.539	9.608	9.856	9.863	9.732
Mean	51.018	51.225	21.311	52.107	50.854

The highest intercorrelations between tests are the correlations between the Thorndike Tests (Parts I and III) and between the Reading Tests (Parts III and IV), the intercorrelations being .65. The lowest correlations, ranging from .36 to .41, are with grades. The intercorrelations of Table XI show that all the tests correlate more highly with each other than with the factor to be predicted, grades. Toops [73], in specifying the qualifications of a Study Performance Test whose purpose was to aid in a more accurate prediction of grades, said:

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1. Tests must correlate positively, preferably highly, with college marks.
2. New tests must correlate low with intelligence tests.
3. New tests must be long enough that each test will correlate highly with an alternate form of itself if repeated to-morrow.

The reliability of the parts used in the General Examination compares very favorably with the reliabilities of other psychological tests. The fact, however, that the tests correlate more highly with each other than with grades probably indicates that the predictive effect of each test on grades, the other three tests being held constant, will be small. This has been found to be the case, the partial correlations being very low, viz., $r_{12.345} = .047$; $r_{13.245} = .125$; $r_{14.235} = .120$; $r_{15.234} = .166$. In other words, the correlation between grades and the Thorndike Test (Part I), the effect of factors in the other three parts being held constant, is but .047. Since the correlation between the Thorndike Test (Part I) and grades was .356, the effect of the factors measured also by Parts III, IV, and VII was considerable.

From the following regression equation there can be estimated the most probable grade received by students knowing their scores on the four parts of the General Examination:

$$X_1 = .039 X_2 + .112 X_3 + .097 X_4 + .130 X_5 + 31.623.$$

The weight of the Thorndike Test (Part I), X_2 , in predicting grades, X_1 , is shown by the above equation to be less than one-half that for the Reading Test (Part IV), X_4 , about one-third that for the Thorndike Reading Test, X_3 , and less than one-third that for the Vocabulary Test, X_5 . The Vocabulary Test had the highest weight in predicting grades. It is probable that the factors measured by the Thorndike Test (Part I) are measured to such an extent by the other tests that the value of the Thorndike Test in predicting grades does not warrant taking time for giving and scoring the test. Evidently, the effect of certain factors measured by the Thorndike Reading Tests is of somewhat more importance in predicting grades than is the effect of those factors measured by the Reading Test (Part IV). The effect of vocabulary seems to be of greater importance than that of reading ability. It might be valuable to devise a test which would measure vocabulary as well as reading ability.

The coefficient of correlation between the grades actually made and grades as predicted from the regression equation, each part

of the General Examination being given proper weights, is called the multiple correlation and is designated by the letter R . It tells also how closely grades are related to the four parts of the General Examination, taken together. The formula for R in this case is:

$$R_{1(2345)} = \sqrt{1 - \frac{\sigma_{1.2345}^2}{\sigma_1^2}}$$

where

$$\sigma_{1.234} = \sigma_1 \sqrt{1 - r_{12}^2} \sqrt{1 - r_{13.2}^2} \sqrt{1 - r_{14.23}^2} \sqrt{1 - r_{15.234}^2}.$$

The multiple correlation between grades and the four parts of the General Examination was .473. Thus the highest possible relationship between grades and the separate parts of the General Examination, the latter being given the best weights for predicting grades, is .47. Since the correlation between the average of the four parts and grades is .46, it is apparent that multiple regression in this situation does not raise the correlation appreciably.

Table XII shows the relationship between grades for the second semester and average grades for both semesters.

TABLE XII

CORRELATIONS BETWEEN SCORES ON PARTS OF THE GENERAL EXAMINATION AND GRADES FOR THE SECOND SEMESTER AND AVERAGE GRADES FOR FIRST AND SECOND SEMESTERS

SCORE	GRADES, SECOND SEMESTER	AVERAGE GRADES, BOTH SEMESTERS
Part I—Thorndike Test	.371 ± .020	.429 ± .019
Part III—Thorndike Test	.368 ± .020	.463 ± .018
Part IV—Reading Test	.381 ± .020	.453 ± .018
Part VII—Vocabulary Test	.354 ± .020	.441 ± .019
S. D.	5.730	5.463
Mean	52.233	51.677

The correlations given in Table XII, between grades for the second semester and the parts of the General Examination, are practically the same as the correlations for the first semester, shown in Table XI. The average of grades for both semesters correlates consistently higher with the individual tests. This is to be expected since average grades are more reliable than grades for either semester alone.

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An observation of the means for grades and General Examination shows them to be over fifty in every case. Since the entire group tested had an average T score of fifty the group used in this study seems to be slightly above the average. The General Examination was given to all students working for any degree, whether graduate or undergraduate, full-time or part-time students. Since only the records of graduate students carrying eight or more points the first semester were used in this study, the higher means are to be expected.

T score values for the group studied are given in Table XIII.

TABLE XIII
T SCORE VALUES FOR 840 GRADUATE STUDENTS

PERCENTILE	GRADES, FIRST SEMESTER	AVERAGE GEN- ERAL EXAMINA- TION SCORE
10	42.79	41.45
25 (Q_1)	47.23	46.23
50 (Med.)	51.65	52.08
75 (Q_3)	56.02	57.71
90	60.09	62.77

The group of graduate students studied included students working for a Master's degree, students expecting to matriculate for the Doctor's degree, and students already matriculated for the Doctor's degree. The last group consisted of 13 students, and the number in the last two groups was 83. The number of students matriculated for the Master's degree was 733. Table XIV is the result of a comparative study made between the students working for a Master's degree and the students expecting to receive the Doctor's degree.

The correlation chart for the Doctor's group shows that only three students were below the mean for the entire group tested

TABLE XIV
DIFFERENCE BETWEEN CANDIDATES FOR MASTER'S AND FOR DOCTOR'S DEGREES
IN GENERAL EXAMINATION SCORES AND GRADES

	CORRELATION BETWEEN GENERAL EXAMINATION AND GRADES	S. D. OF GRADES	S. D. OF SCORES ON GENERAL EXAMINATION	MEAN OF GRADES	MEAN OF SCORES ON GENERAL EXAMINATION	NO. OF CASES
Master's ..	.508 $\pm$.018	5.280	7.888	51.083	50.785	733
Doctor's ..	.399 $\pm$.063	4.713	7.987	56.398	57.229	83

in both grades and General Examination scores. Twenty-four per cent of the Doctor's group of students were below the mean in one trait, either average grades or average General Examination scores. A number of these students undoubtedly would never matriculate for the Doctor's degree. Of the thirteen students who had already matriculated only one was below the mean in average General Examination scores, and one was below the mean in grades.

The correlation between General Examination scores and grades for the Doctor's group may be low for several reasons: (1) the variability for grades and General Examination scores is smaller for this group than for the entire group studied; (2) students already matriculated may not be as interested in their courses as in their individual research problems; (3) students not yet matriculated may be working harder in their courses in order to be better prepared for their matriculation examinations; (4) the number of cases is small and the P. E. large.

In spite of the apparently low predictive value of the General Examination for candidates for the Doctor's degree, some very definite conclusions may be drawn. A student below the mean in both General Examination score and average grades has a very small chance of passing the matriculation examinations. A student below the mean in either General Examination or grades has less than one chance in four of matriculating for the Doctor's degree.

Differences in predictive value of psychological examinations and academic success in colleges in universities exist because of the variation in academic courses and standards. Kuenzel and Toops [44] found at Ohio State University that the College of Engineering had a superior quality of student; the College of Agriculture had an inferior quality; and the "graduate school represented by far the highest quality of scholarship of any of the previous mentioned groups." Symonds [69] found at the University of Hawaii that the marks in the College of Arts and Sciences were more reliable than the marks in the College of Applied Science.

Differences among departments were discovered at Teachers College. The means of grades, means of General Examination scores, variabilities, and correlations between grades and General Examination scores varied considerably among the depart-

ments studied. Table XV illustrates these differences. The departments are placed in the order of their correlations between General Examination scores and grades.

TABLE XV

DIFFERENCES AMONG DEPARTMENTS IN TEACHERS COLLEGE IN GENERAL EXAMINATION SCORES AND AVERAGE GRADES FOR BOTH SEMESTERS

DEPARTMENT	CORRELATION BETWEEN GENERAL EXAMINATION AND GRADES	S. D. OF GRADES	S. D. OF SCORES ON GEN- ERAL EXAMI- NATION	MEAN OF GRADES	MEAN OF SCORES ON GEN- ERAL EXAMI- NATION	NO. OF CASES
Education	.631 $\pm$.022	5.537	8.417	52.205	53.015	346
English and French....	.560 $\pm$.047	6.126	6.803	50.849	53.000	86
Household Arts	.558 $\pm$.041	5.047	6.747	51.008	47.737	129
Religious Education and Advisers	.548 $\pm$.061	5.843	7.394	51.639	53.098	61
Elementary Education.	.420 $\pm$.058	5.751	8.677	52.263	51.211	95
Physical Education	.323 $\pm$.080	4.242	7.605	50.404	50.491	57
Fine Arts and Music...	.314 $\pm$.078	4.482	7.898	51.587	49.333	63

The departments listed in Table XV were separated into two groups—School of Education and School of Practical Arts. The latter school included the departments of Household Arts, Physical Education, and Fine Arts. The School of Education included the groups of Education, English and French, Religious Education and Advisers, and Elementary Education. All students whose majors were indicated as Clothing, Textiles, Cooking, Foods, Home Economics, Institutional Management, Nutrition, and Nursing were included in the Household Arts group. Physical Education and Health were combined. Fine Arts and Music were also combined. Students in the fields of Religious Education, Advisers of women and girls, and Deans were studied together. The group of Elementary Education included Primary Education and Child Development. Those students in the School of Education not included elsewhere were included in the group of Education.

In the field of Education the General Examination seems to have the more significance so far as predicting grades is concerned. It may be that the academic examinations in the departments of this field are more like the tests in the General Examination; it may be that success in these departments is

measured by the psychological tests more accurately than in the other departments. At any rate, it is obvious that the General Examination does not adequately measure success in the departments of Fine Arts and Music and Physical Education. In these departments it is reasonable to conclude that factors other than those measured by psychological tests would probably have more weight in predicting success than in any of the other departments.

From the data at present available it may be concluded that the General Examination differentiates among students in the field of Education more accurately than among students in the School of Practical Arts (other than Household Arts). To reach final conclusions, however, it would be necessary to make a more thorough investigation of a larger number of cases in the departments within the schools of Education and Practical Arts. Department placement examinations may be included in the General Examination where their validity for predicting success within the department justifies their use. High correlations, then, in certain departments would give warrant for rather definite advice to students planning to pursue major courses in those departments.

The correlations between academic achievement and general ability usually vary for men and women. Johnston [33 and 34] says of sex differences in the University of Minnesota: "Women are given better marks than men in both high schools and college." Concerning the Army Alpha ratings necessary for academic success, he states: "Women ranking below 30 and men ranking below 45 in combined ratings would fail to attain an average of C —." Louttit [46] in reporting on sex differences in Hobart College states that the median Alpha scores for women were lower than for men although the per cent of students dropped was lower among women. He adds that the correlations with grades of Alpha scores were generally lower for the women. O'Shea [52] found as a result of an investigation of the intellectual status and educational progress of freshmen in colleges in Mississippi that "men were distinctly ahead of women in arithmetic," while women were ahead of the men in the "artificial language" test of the Thurstone Intelligence Test. He also reported that, although men were about three school years older chronologically than women, the latter had been in school an average of two years more than men.

Differences between the men and women studied in this investigation were also found. Tables XVI and XVII show the correlations among the four parts of the General Examination and grades for the first semester (1-I), second semester (1-II), and the average for both semesters (1-A) for 214 men and for 623 women.

Tables XVI and XVII show that in every case the correlations were higher for men than for women. The correlation between average General Examination scores and average grades for both semesters was .565 for men and only .385 for women. The reliability of grades was .717 for men and .623 for women. The greatest sex difference was found in the correlation between average grades and Part III—the Thorndike Test, the correlations being respectively .523 and .295. The smallest variation was found in the intercorrelations between the two reading tests. A possible explanation of the higher relationships found is the fact that the variability was greater, in every trait, for men than for women. That this is true was found by using a formula for correcting a correlation affected by selection in both variables. This formula is given by Kelley [39, p. 229]. The correlation of .642 between average General Examination scores and average grades was changed to .496 when the variabilities of both measures were decreased.

A study of the differences between the means for the two groups showed that the largest variation was in the Thorndike Test (Part I), the men exceeding the women by almost 3.5 T scores. The women excel, however, in Part IV—the Reading Test—in a lesser degree. The difference between the means of the grades is probably not significant.

Whether there is a difference between the men and women for the individual parts of the General Examination in predicting grades can be seen from the regression equations following:

For men: $X_{1-I} = -.055 X_2 + .071 X_3 + .088 X_4 + .308 X_5 + 30.491$.

For women: $X_{1-I} = .090 X_2 - .018 X_3 + .135 X_4 + .246 X_5 + 27.033$.

Total group: $X_{1-I} = .039 X_2 + .112 X_3 + .097 X_4 + .130 X_5 + 31.623$.

In every case the weight given to the Vocabulary Test is greatest. The weight given to the other three tests vary, however. For men Part I—Thorndike Test—has the least value in predicting grades; for women Part III—Thorndike Test—has the

TABLE XVI
CORRELATIONS AMONG SCORES ON PARTS OF THE GENERAL EXAMINATION AND GRADES FOR 214 MEN

	1-A AVERAGE GRADE	1-I GRADES, FIRST-SE- MESTER	1-II GRADES, SECOND SE- MESTER	2 SCORE ON PART I— THORNDIKE TEST	3 SCORE ON PART III— THORNDIKE TEST	4 SCORE ON PART IV— READING TEST	5 SCORE ON PART VII— VOCABULARY TEST	6 AVERAGE GENERAL EXAMINA- TION SCORE
1-A. Average Grade								
1-I. Grades, First Semester								
1-II. Grades, Second Semester ...								
2. Score on Part I—Thorndike Test			.717 ± .028	.522 ± .043 .481 ± .048 .504 ± .046	.584 ± .038 .518 ± .045 .523 ± .044	.547 ± .042 .482 ± .048 .491 ± .047	.521 ± .044 .505 ± .046 .419 ± .055	.642 ± .033 .576 ± .040 .565 ± .040
3. Score on Part III—Thorn- dike Test					.691 ± .029	.656 ± .033	.610 ± .036	
4. Score on Part IV—Reading Test						.679 ± .030	.641 ± .034	
S. D.	6.352	7.071	6.618	10.676	11.012	10.433	10.844	9.267
Mean	51.547	51.065	51.944	54.631	52.551	50.869	52.467	52.776

TABLE XVII
CORRELATIONS AMONG SCORES ON PARTS OF THE GENERAL EXAMINATION AND GRADES FOR 623 WOMEN

	1-A AVERAGE GRADE	1-I GRADES, FIRST SE- MESTER	1-II GRADES, SECOND SE- MESTER	2 SCORE ON PART I— THORNDIKE TEST	3 SCORE ON PART III— THORNDIKE TEST	4 SCORE ON PART IV— READING TEST	5 SCORE ON PART VII— VOCABULARY TEST	6 AVERAGE GENERAL EXAMINA- TION SCORE
1-A. Average Grade								
1-I. Grades, First Semester				.384±.034	.405±.033	.412±.032	.406±.033	.486±.029
1-II. Grades, Second Semester ...			623±.021	.331±.037	.386±.034	.372±.034	.364±.035	.406±.033
2. Score on Part I—Thorndike Test				.325±.037	.295±.039	.330±.037	.329±.037	.385±.034
3. Score on Part III—Thorn- dike Test					.639±.021	.577±.023	.521±.026	
4. Score on Part IV—Reading Test						.655±.019	.550±.025	
S. D.	5.121	6.094	5.388	8.902	9.311	9.562	9.305	7.665
Mean	51.722	51.172	52.332	50.172	50.928	52.629	50.406	51.132

least weight; and for the total group Part III—Thorndike Test—has the highest weight of the first three tests. On the whole, however, the sex differences are not significant enough to warrant very definite procedures for advice to either men or women.

An attempt to determine certain tendencies and relationships between the age of the group studied, the scores on the General Examination, and grades was made. Table XVIII shows the correlations with age from men, women, and the total group studied.

The regression equation showing the maximum weights for the average General Examination scores (X_6) and age (X_7) in predicting grades for the first semester (X_{11}) follows:

$$X_{11} = .375 X_6 + .081 X_7 + 27.294.$$

The multiple R between first semester's grades and the weighted values for age and the average General Examination scores was .477. The coefficient of correlation between grades for the first semester and average General Examination scores was .459.

Table XVIII shows practically no sex differences between the correlations of age with the General Examination scores and grades. The standard deviations and means for men and women are also about the same.

The correlations of age with grades are positive but low and with General Examination scores practically zero. That this is not the case in undergraduate institutions is to be expected. Colvin [13] found a negative correlation between the Brown University Test average and age of $-.24$. Jones [36] in reporting on the college standing of freshmen of various ages said: "There is throughout a clear correlation between lower age of admission and high scholarship." He recommends as a result of his study that "only the exceptional student among these who are considerably above the average age should be admitted to college at all." Murray [51] reported that at Sweet Briar College the Thurstone Intelligence Test scores tended to vary inversely with the age of freshmen from 16 to 21 while grades tended to vary directly with age. Whinery [78] reported the following results:

1. Students who receive the lowest ratings on psychological tests tend uniformly to be older than those who receive

TABLE XVIII
CORRELATIONS WITH AGE, OF THE GENERAL EXAMINATION SCORES AND GRADES

GROUP	AVERAGE GRADE	GRADES, FIRST SEMESTER	GRADES, SECOND SEMESTER	SCORE ON PART I— THEORNDIKE TEST	SCORE ON PART III— THEORNDIKE TEST	SCORE ON PART IV— READING TEST	SCORE ON PART VII— VOCABULARY TEST	AVERAGE GENERAL EXAMINA- TION SCORE
Men	.135±.041	.121±.041	.134±.041	.019±.038	— .140±.041	— .036±.045	.189±.039	.009±.046
Women	.119±.027	.117±.027	.100±.027	.020±.027	— .187±.026	— .169±.026	.261±.025	— .028±.027
All	.123±.023	.118±.023	.109±.023	.020±.023	— .172±.022	— .134±.023	.240±.022	— .017±.023
MEN WOMEN ALL								
S. D.				7.379	7.658	7.587		
Mean				31.523	31.444	31.465		
N				214	623	837		

highest ratings. The median age for Class I on the tests was 18.16 years while for Class V it was 19.52 years.

2. Youngest students make the highest grades.
3. Youngest students receive the highest intelligence ratings.
4. There is a greater variation in age among those who receive low ratings.

Wilson [76] found that the mean age of 250 freshman women at the University of Oklahoma was 19.02 years. The correlation between age and brightness was $-.12$; between age and grade average $-.03$.

Among graduate students who come to Teachers College for advanced work after varying years and kinds of experience, it is scarcely possible to consider age an influencing factor in academic success. The correlations are all low and their probable errors large, so it seems clear that age is not an important factor.

The results of studying the predictive value of the General Examination scores show that, although there is a definite relationship between grades and test scores, accurate prediction in the case of individuals cannot be made. With additional information, however, more definite prediction can probably be made. There is urgent need for further experimentation and investigation concerning the factors that affect academic success and for the means of measuring such factors early in the academic career of the graduate student. The technique of prediction based upon the regression equation and multiple correlation can be used as a means of determining the value of the factors measured.

SUMMARY

A summary of the relations found between the General Examination given at Teachers College in October, 1927, and grades during the academic year of 1927-28 follows:

1. The correlation between average General Examination scores with grades for the first semester was $.46$; with grades for the second semester $.44$; and with average grades for both semesters $.54$.

2. The per cent of students in quintile groups for grades was given for:

- a) The top 25 per cent in the General Examination.
- b) The bottom 25 per cent in the General Examination.
- c) The top 10 per cent in the General Examination.

d) The bottom 10 per cent in the General Examination.

3. The predictive index for the relation between the average General Examination scores and grades was .12.

4. The relation between average General Examination scores and grades is linear.

5. The regression equation for predicting grades from the average General Examination scores is given.

6. Intercorrelations for the parts of the General Examination and grades for the first semester are given.

7. The regression equation for predicting grades from the individual parts of the General Examination is given.

8. The multiple correlation for the relationship between grades and the individual parts of the General Examination was .47.

9. Correlations between the separate parts of the General Examination and grades for the second semester are given.

10. Correlations between the separate parts of the General Examination and average grades are given.

11. T score values for the group studied are given.

12. A comparative study was made between students who were candidates for the Master's degree and those who were candidates for the Doctor's degree.

13. Differences among colleges in other universities are cited.

14. The General Examination has the highest predictive value in the department of Education at Teachers College.

15. The General Examination has little effect in predicting success in the departments of Fine Arts and Music and Physical Education.

16. Correlations among psychological tests and grades are consistently higher for men than for women. The variability of the parts of the General Examination is greater for men in every case, however.

17. The correlations with age of the General Examination scores and of grades are positive but low.

18. Relations of age with the psychological tests and grades for undergraduate institutions are given.

CHAPTER V

A STUDY OF DISCREPANCIES BETWEEN GRADES AND GENERAL EXAMINATION SCORES

The correlation between General Examination scores and academic grades is high enough to indicate that there is a definite relation between the two. There is also evidence of a considerable difference between the best and the poorest students in the examination in the percentage receiving high or low grades. Although the tests differentiate students to a surprising degree into broad groups, they are still unsafe for prediction in individual cases, as is indicated by a predictive index of but .12. It is thus necessary to assume that certain factors other than those measured by the tests are operative in changing the relative scholastic standing of individuals. Some of these factors have been discussed in previous chapters.

An attempt was made during the academic year of 1927-28 to ascertain some of the reasons for wide discrepancies between General Examination scores and grades. A questionnaire was sent to all students who varied more than 9 or less than 3 T scores between the General Examination scores and grades. The groups were as follows:

Group A. Students 10 or more T scores higher in examination scores than in grades.

Group B. Students with less than 3 T scores variation in grades and examination scores.

Group C. Students 10 or more T scores higher in grades than in examination scores.

The number and per cent of questionnaires answered and returned for each group were as follows:

GROUP	NO.	PER CENT
A	73	74
B	164	74
C	54	61

The questionnaires were numbered for purposes of identification but the students were asked not to sign their names, thus being assured that their responses would be treated confidentially. Since students were not informed of their scores on the General Examination and since grades at Teachers College for the academic year are also confidential, the students had no definite information concerning why the questionnaire was sent. Question 23 of the questionnaire led most of the students to assume that a discrepancy existed between their General Examination scores and grades. Many of them hazarded guesses concerning the group in which they stood—higher in grades or higher in the General Examination. Question 23 follows:

Write as briefly as possible any other information which may account for any difference between grades and score on the General Examination.

A copy of the letter and questionnaire sent to the students will be found in the Appendix.

The questionnaires were not sent until the second semester, in order that more reliable responses might be obtained concerning attitudes toward class work during the first semester. The lapse of time since the examination may, however, have affected the reliability of responses to questions concerning the General Examination. The fact that some of the students hazarded guesses concerning the reason the questionnaire was sent may also have affected the responses. Many of the differences existing between groups A and C may be due to rationalization on the part of the students. Consequently, it is impossible in most cases to conclude from the responses to the questionnaire the real reasons for discrepancies between grades and General Examination scores.

The questionnaire consisted of 23 questions. The first 13 questions concerned the student's experience with and attitude toward psychological examinations; the next 9 concerned the student's academic work during the first semester of 1927-28; and the last concerned both General Examination scores and grades. The questions which were found to have been ambiguous will be omitted in the discussion of the results found.

The first question was: "Do you feel that you did your best on the General Examination?" The per cents of those who answered "Yes" of the three groups, A, B, and C (higher in Gen-

eral Examination scores, no variation, and higher in grades), are respectively 39, 32, 15. Whether the differences between 39 and 32, 32 and 15, and 39 and 15 per cents are significant was calculated by using the following well-known formulæ:

$$\sigma_{\%} = \sqrt{\frac{pq}{N}}$$

where p was the per cent who said "Yes" and q the per cent who said "No,"

$$\sigma_{\%A - \%B} = \sqrt{\sigma^2_{\%A} + \sigma^2_{\%B}}$$

assuming that the errors of observation in the groups A and C were uncorrelated,

$$\frac{A - B}{\sigma_{A - B}}$$

which was converted into the number of chances in 100 that the true difference between A and B was greater than zero.

Tables XIX and XX show the differences among those higher in the General Examination scores than in grades, those who were higher in grades than in the General Examination scores, and those who did not vary. The chances in 100 that the true differences were greater than zero are given in the last three columns.

McCall considers a value of 2.78 for $\frac{x}{\sigma}$, or 99.7 chances in 100 that the true difference is greater than zero, as "practically certain" that differences are above zero. Conclusions will be drawn on the basis that 99.7 chances or more in 100 show a significant difference between Groups A and C.

There is a significant difference between Groups A and C concerning the proportion of students who felt that they did their best on the General Examination. It may be that many students in these groups, realizing where the discrepancy existed, attributed the difference to the fact that they did or did not do their best on the examination. On the contrary, it may be that there were factors other than ability which actually influenced examination scores. A larger proportion of these factors causing lowered ratings may have affected the students in Group C.

A significantly larger percentage of students in Group A had taken psychological tests before taking the General Examination. The relationship between the number of tests taken before

TABLE XIX

DIFFERENCES AMONG GROUPS HIGHER IN GENERAL EXAMINATION SCORES (A),
HIGHER IN GRADES (C), AND NO VARIATION (B), IN
RESPONSES TO QUESTIONNAIRE

QUESTION	PER CENT IN GROUP			A-B	B-C	A-C	CHANCES IN 100		
	A	B	C	σ_{A-B}	σ_{B-C}	σ_{A-C}	A-B	B-C	A-C
1. Did their best on the General Examination	39	32	15	.99	2.80	3.09	83.9	99.7	99.9
2. Taken psychological tests before	51	45	28	.85	2.35	2.72	80.2	99.1	99.7
5. Well on second day of General Examination	78	82	72			.77			77.9
6. Correct concerning which day score was higher on General Examination	41	46	48	.72	.26	.79	76.4	60.2	78.5
7. Correct concerning purpose of General Examination	44	36	31	1.17	.68	1.53	87.9	75.1	93.7
8. Unfavorably affected by examiner's presence	7	9	13	.54	.78	1.09	79.5	71.8	77.6
13. Correct concerning position									
a) Mathematics score	68	82	53	.89	1.15	1.70	81.0	87.0	95.5
b) } Reading score	63	68	64	.77	.55	.11	77.9	70.8	54.0
c) }									
d) Vocabulary score	63	61	64	.29	.39	.11	61.0	65.0	54.0
14. Median per cent of courses especially interested in	43	67	77	1.09	.39	1.33	86.2	65.5	90.8
15. Median per cent of courses mildly interested in	30	22	17	.38	.20	.58	64.8	57.9	71.9
21. Worked for remuneration ...	49	37	29	1.77	1.12	2.40	96.1	86.8	99.2
21. Median number of hours working for remuneration	*24	*15	*16	.51	.05	.39	69.5	51.9	65.1
22. Felt handicapped in courses during semester	47	33	29	2.08	.61	2.29	98.1	72.9	98.9
23. Correct concerning relation between General Examination score and Grades	37	2	33			.48			68.4

* Number of hours per week—not per cent.

and Groups A, B, and C is positive and is expressed by a coefficient of contingency of .249.

Question 4 concerned the students' emotional attitudes toward the examination. The possible responses were: (1) very nervous, (2) slightly nervous, (3) tense, (4) calm, (5) indifferent. The coefficient of contingency, C_{ABC} , for the three groups with the five responses was .287. The per cents of students who were very nervous were, for Groups A, B, and C respectively, 4, 12, and 22, while the per cents of students who were indifferent were respectively 21, 19, and 9.

TABLE XX

PER CENTS AND COEFFICIENTS OF CONTINGENCY FOR GROUPS HIGHER IN
GENERAL EXAMINATION SCORES (A), HIGHER IN GRADES (C), AND
NO VARIATION (B) IN RESPONSES TO THE QUESTIONNAIRE

QUESTION	PER CENT IN GROUP			COEFFICIENT OF CONTINGENCY*
	A	B	C	
3. Number of psychological examinations taken before October, 1927				
a) None	49	17	72	.249
b) One	25	47	15	
c) Two	15	18	6	
d) Three or more	11	18	7	
4. Attitude during the examination				
a) Very nervous	4	12	22	.287
b) Slightly nervous	25	23	22	
c) Tense	24	25	43	
d) Calm	27	21	4	
e) Indifferent	21	19	9	
5. Physical condition—first day				
a) Very ill	1	4	9	.220
b) Slightly indisposed	22	27	46	
c) Well	77	69	44	
9. Affected by time element during examination				
a) Favorably	8	4	0	.266
b) Neutral	42	29	11	
c) Unfavorably	50	67	89	
10. Attitude toward General Examination				
a) Favorable	37	23	16	.231
b) Neutral	21	26	10	
c) Unfavorable	44	51	74	
11. Usual method of working during examinations				
a) Work quickly—do not check	6	5	0	.189
b) Work quickly—usually check	75	54	33	
c) Work at normal rate	10	23	24	
d) Work slowly—do not check	0	2	7	
e) Work slowly—usually check	10	11	35	

* The actual number of cases, not per cents, was used in the calculation of the coefficients of contingency.

There was a tendency for students in Group A to answer that they were in better physical condition during the examination on the first day than for those in Groups B or C, C_{ABC} being .220. On the second day there was practically no difference between Groups A and C. Since the first day was unusually warm and the examination was held in the afternoon, it may be that the physical condition of some of the students did affect their examination scores.

Less than fifty per cent in each of the groups guessed correctly

on which day they did better in the examination. This is even less than would be expected from chance guessing. It would seem, then, that factors not common to both days could not have been significant in affecting examination scores.

There were interesting responses to Question 7, "At the time you took the General Examination what did you think the purpose of the examination was?" The responses were as follows: for experiment or research, to standardize tests for future use, for future classification of students, to find the relation between intelligence tests and grades, for future admission requirements and selection of students, to obtain intelligence ratings for immediate use, entrance requirement, no idea. The first four answers were considered correct, the last four incorrect. There was some difference shown among the groups in the per cent of correct conjectures concerning the purpose of the General Examination, Group A having the largest per cent correct. The difference between Groups A and C is not "practically certain," however, since the chances in 100 that the true difference is greater than zero are but 93.7. It is obvious that some of the responses were not the students' ideas at the time of the examination, viz., the fourth reason—to find the relation between intelligence tests and grades.

There was practically no difference among the groups concerning their reactions to the effect of the examiner's presence in the room.

The time element during the examination affected more of the students in Group C unfavorably than it did those in Groups A or B. The coefficient of contingency showing the relationship between Groups A, B, and C with the favorable neutral and unfavorable effect of timing was .266.

The responses to Question 10, "What was your attitude toward the General Examination?" showed surprising frankness on the part of the students. The responses were divided into three classifications: (1) favorable toward the examination, (2) neutral, (3) unfavorable. Some of the responses in the first classification were: enjoyed it, coöperative, favorable toward, liked it. The second classification included: acquiescent, indifferent, no objection, nonchalant. The third classification included responses such as: disgust, dislike, irritation, fear, bolshevistic. The coefficient of contingency for the three groups and the three

classifications, was .231, Group C being the most unfavorably impressed.

"What is your method of working in any examination?" In answering this question there was a slight tendency for students in Group A to judge that they worked more quickly than the students in the other groups. C_{ABC} for the five methods of working was .189.

No clear relation was found between the handicaps during the examination and the three groups studied.

Students were able to judge to some extent their weakest and strongest points as far as mathematics, reading ability, and vocabulary were concerned. Differences among the groups were not significant. Students in Group A were able to guess their relative positions in mathematics somewhat better than those in Group C, however.

There is a slight tendency for students in Group C to be more interested in their courses than for those in Groups A and B. The greatest difference, although not a "practically certain" one, exists between Groups A and C in the median per cent of courses in which the students were especially interested.

Questions 17-20 were apparently ambiguous. Some considered headaches and colds serious illnesses, while others responded that measles or a broken arm did not affect their academic work.

Question 21 concerned work for remuneration done by the student. A larger per cent of students in Group A did outside work than was true of the other two groups. The percentages were as follows for Groups A, B, and C respectively: 49, 37, and 29. The median number of hours was not significantly different for the three groups, however. From the group studied, it seems that outside work handicaps graduate students in their academic work.

Outside work on the part of the students in undergraduate institutions, however, does not seem to handicap them in their academic work. Book [6] investigated the factors that affected success in college at Indiana University. His study of the relation between academic success and work for remuneration showed that students who were compelled to make their way through college in part or as a whole spent less time in study than did students not compelled to do any outside work, made practically as many credit points during the first semester in

college, and wasted less time. He found, too, that 65.9 per cent of the boys and 50.4 per cent of the girls did some outside work to help make their way through college, and that "working students succeed better with their academic work . . . devote more efficient methods to work, or have a stronger motive or determination to succeed with their college work."

A study [19] conducted by Francis McCabe, of Harvard University, of students in technical school in Cambridge, Massachusetts, and of 758 boys from 13 to 20 years old showed that:

No outstanding difference existed between the workers and nonworkers in school marks.

Judged by failure marks, the workers are a little more successful in school.

Judged by honor marks, the nonworkers are a little more successful in school.

Group intelligence tests show no distinction between the nonworkers and workers.

Those who are compelled to work to support themselves are more successful in academic work than the group working for pleasure afforded by extra money.

Those obliged to work have slightly less mental ability than either nonworkers or workers for extra money

Those obliged to work are most successful in academic work; nonworkers rank second, and those working for extra money are least successful.

Greenleaf [24 and 25] reported that in "122 representative colleges and universities of the United States, 55 per cent men and 22 per cent women are working their way through college." Concerning the effect of outside work on academic achievement, he quoted President Coleman, of Reed College, who said:

Some of the best students who come to us very largely earned their way through high school and continue to earn their way through college. . . . While the burden of entire support seems in these days too heavy for a student to carry with fairness to himself, there can be no question that some responsibility steadies the student and gives him an incentive to make the best use of his time.

Greenleaf added that Dean Bursley, of the University of Michigan, said:

In regard to the scholastic standing of our young men who work, we have no figures showing this but are of the opinion that the work does handicap some of them in obtaining good grades. However, some of our self-supporting students do have excellent marks, and we consider the training they get in working their way through worth something to them,

as many business firms asking for graduates to fill positions, desire those who have worked while attending school.

Laird [45] investigated factors causing disparity between intelligence and scholarship in students in a small western state college. The correlation between the Thorndike Intelligence Test for High School Graduates and grades for a standard group selected to use as a basis for comparison was .487. Thirty-one students working for their board had a median intelligence score 9 points below the campus median and had proportionately few of the high and more of the low intelligence ratings. The correlation between intelligence scores and grades was .530. Ten students earned their entire way through college; their median intelligence score was 15 points below the median of the campus. A zero correlation was found between intelligence scores and grades for this group. The grades for this group were, however, average.

A larger per cent of students in Group A believed that they were handicapped in their courses during the first semester. Whether their handicaps were really of importance in affecting their work or whether they rationalized concerning the differences that they supposed existed cannot be determined from the data. Some of the handicaps listed were: insufficient preparation, difficulty in adjustment, domestic difficulties, emotional difficulties throughout the semester, commuting, and poor choice of courses.

Responses to the last item on the questionnaire did not contribute significant reasons for discrepancies between General Examination scores and grades. Many of the students, however, indicated conjectures concerning their relative positions in the examination scores and grades. The per cents who did so for the three groups were as follows:

Group A. Thirty-seven per cent guessed correctly, 24 per cent guessed incorrectly.

Group B. Two per cent guessed correctly, 36 per cent guessed incorrectly.

Group C. Thirty-three per cent guessed correctly, 7 per cent guessed incorrectly.

The results of this questionnaire merely show tendencies for certain factors to be associated with discrepancies between General Examination scores and grades. There is little indication

of the causes or effects of these factors. Some of these questions would probably have been more accurately answered if asked at the time of the examination, and some of the difficulty of rationalization might have been prevented.

SUMMARY

A summary of the results found from a study of responses to the questionnaire follows:

1. The three groups studied were:

Group A. Students 10 or more T scores higher in examination scores than in grades.

Group B. Students less than 3 T scores variation in grades and examination scores.

Group C. Students 10 or more T scores higher in grades than in examination scores.

2. Thirteen questions of the questionnaire were concerned with the psychological examinations, and 10 questions were concerned with academic work.

3. A table showing the differences among Groups A, B, and C in the responses to the questionnaire is given.

4. A table showing coefficients of contingency for some of the questions is given.

5. There was a significant difference between Groups A and C in the per cent of students who felt that they did their best on the General Examination; in Group A, there were 39 per cent; in Group C, 15 per cent.

6. A larger per cent of students in Group A than in Groups B or C had taken psychological tests before.

7. A larger per cent of students in Group A worked for remuneration than in Groups B or C.

8. The relations between the three groups studied and responses to Questions 3, 4, 5 (first day), 9, 10, and 11 were expressed as coefficients of contingency, ranging from .19 to .29.

CHAPTER VI

SUMMARY AND INTERPRETATION

The purpose of this investigation has been to discover some means of guiding students upon their entrance to Teachers College. The need for such guidance has been felt for some time. The increased registration and resulting large classes make it practically impossible for an instructor to recognize individual students' needs until a considerable part of the semester is gone. Graduate students, particularly, have been at a disadvantage since the majority of them remain at Teachers College but one year and hope, during that time, to gain renewed inspiration and ideas concerning their work. In recognition of the fact that psychological tests have been useful in classifying students in undergraduate institutions, a General Examination was devised and administered by the department of Psychology at Teachers College. The examinations have, at present, not progressed beyond the experimental stage, but it is hoped that a study of their value in predicting academic success will make them useful as an aid in advising entering students.

That the psychological tests are incomplete and inaccurate as far as predicting academic success is concerned is admitted. No pretense is made that the factors that these tests measure are the only factors determining success in college. Nevertheless, if these objective measures offer some means, however slight, of predicting grades, a starting point has been reached in guidance. The tests will eventually find their greatest usefulness when used in conjunction with other measures that predict success to any degree.

Many undergraduate institutions have used psychological tests for purposes of gaining objective information concerning their students. Correlations found between tests and academic grades in over fifty colleges and universities are given early in this study. It was found that the average correlations between tests used from 1912-18 and college grades was about .40. The aver-

age correlation between tests used since 1918 and grades was between .43 and .48. Batteries of tests devised by individual colleges for local use predicted academic success, on the whole, better than did standardized tests.

A study was made of the results of the four parts of the General Examination given in October, 1927. Eight hundred and forty graduate, English-speaking students, taking eight or more semester hours work during the first semester, comprised the group studied. The scores on the General Examination as well as the academic grades were converted into T score values. Reliability coefficients of grades and of the individual parts of the examination were as follows:

1. Grades—first and second semesters $r_{1I} = .65$
2. Thorndike Test (Part I) $r_{2II} = .89$
3. Thorndike Test (Part III) $r_{3III} = .89$
4. Reading Test (Part IV) $r_{4IV} = .77$
5. Vocabulary Test (Part VII) $r_{5V} = .91$

The question that this investigation attempted to solve was: To what extent do the ratings obtained on the General Examination predict academic achievement?

SUMMARY

A summary of the findings and conclusions that can be drawn from these ratings follows:

1. The relation between average General Examination scores and grades for the first semester was expressed as:

- a) A Pearson coefficient of correlation .46.
- b) A predictive index of .12.
- c) The per cent of students in quintile groups for grades for the top and bottom 25 per cent on the General Examination and the top and bottom 10 per cent on the General Examination.
- d) Correlation ratios of .47 and .48.
- e) A regression equation for predicting grades (X_1) from the average General Examination score (X_6).

$$X_1 = .37X_6 + 31.85.$$

2. The relation between the four parts of the General Examination and grades was expressed as:

- a) Coefficients of correlation with first semester's grades ranging from .36 to .41.
- b) Coefficients of correlation with second semester's grades ranging from .35 to .38.
- c) Coefficients of correlation with average grades for both semesters from .43 to .46.
- d) A regression equation for predicting grades (X_1) for the first semester from the individual parts of the General Examination.

$$X_1 = .04 X_2 + .11 X_3 + .10 X_4 + .13 X_5 + 31.62.$$
- e) A multiple R for the relationship between grades for the first semester and the individual parts of the General Examination of .47.

3. A comparative study of candidates for the Master's degree and for the Doctor's degree showed that:

- a) There was a difference between the means in grades of 5.32 T scores.
- b) There was a difference between the means in General Examination scores of 7.44 T scores.
- c) The correlation between examination scores and average grades for both semesters was .40 for candidates for the Doctor's degree and .51 for candidates for the Master's degree. The S. D. of grades for the Master's group was greater.
- d) Only 3 students (or 5 per cent) in the Doctor's group were below the mean for the entire group tested in both grades and General Examination scores. Consequently, it may be concluded that a student below the mean in both the General Examination scores and average grades has a very small chance of passing the matriculation examinations.
- e) A student below the mean in either General Examination scores or grades has less than one chance in four of passing the matriculation examinations.

4. Differences among departments of Teachers College were found to be as follows:

- a) The General Examination has the greatest value for predicting academic success in the department of Education at Teachers College.

- b) The General Examination contributes little toward predicting success in the departments of Fine Arts and Music and Physical Education.

5. A study of sex differences revealed that:

- a) Correlations among the psychological tests and grades were consistently higher for men than for women. The standard deviations of the parts of the General Examination were greater, in every case, for men than for women.
- b) The means of grades were practically equal for men and women.
- c) The means of General Examination scores showed that the largest variation was in the Thorndike Test (Part I), the men exceeding the women. The women, however, exceeded the men in the Reading Test (Part IV).

d) The regression equations follow:

For men: $X_1 = -.06 X_2 + .07 X_3 + .09 X_4 + .31 X_5 + 30.49$.

For women: $X_1 = .09 X_2 - .02 X_3 + .14 X_4 + .25 X_5 + 27.03$.

6. A study of the relation of age with General Examination scores and grades showed that:

- a) The correlations were zero for each sex.
- b) Practically no sex differences were found.
- b) The regression equation for predicting grades (X_1) from average General Examination scores (X_6) and age (X_7) was:

$$X_1 = .38 X_6 + .08 X_7 + 27.29.$$

- d) The multiple R between grades and weighted values for age and average General Examination scores was .48. Information concerning the age of graduate students at Teachers College is of little practical value in predicting academic success.

7. A study of the discrepancies between grades and General Examination scores was made as a result of a questionnaire sent to:

Group A. Students 10 or more T scores higher in examination scores than in grades.

Group B. Students with less than 3 T scores variation in grades and examination scores.

Group C. Students 10 or more T scores higher in grades than in examination scores.

The results of this study showed that:

- a) There was a significant difference between Groups A and C in the per cent of students who felt that they did their best on the General Examination. Thirty-nine per cent of Group A and fifteen per cent of Group C answered "Yes" to this question.
- b) A larger per cent of students in Group A than in Groups B or C had taken psychological tests before.
- c) A larger per cent of students in Group A worked for remuneration than in Groups B or C.
- d) There was a tendency for students in Group A to respond more favorably toward the General Examination and for students in Group C to respond more favorably toward their courses during the first semester.

An interpretation of the results indicates some practical use that can be made of the method of study here presented and of the information thus made available. It is obvious that, except in the case of the students very high or very low in the General Examination score, differentiations cannot yet be accurately made. The students in the highest ten per cent in the General Examination score should be encouraged to do work of a superior order and be given advice concerning individual problems. Students low in the General Examination score, other things being equal, should be advised against taking more than an average load and probably should also be discouraged from working for remuneration. It is necessary, however, that both students and advisers be aware of the fact that high scores on the General Examination are probably more reliable than low scores. It would be reasonably safe to assume that a student in the upper group on the examination would, under ordinary circumstances, do satisfactory academic work, whereas the fact that an individual is low in the examination is not necessarily an indication that he will not do satisfactory work. Prospective candidates for the Doctor's degree should also be informed of their chances for success in the matriculation examinations on the basis of both General Examination scores and grades.

It is important to consider the fact that the success of the stu-

dent in his work after graduation is of far more concern than mere scholastic success. Whether matriculation and study in Teachers College have been of practical value to the student is of far more importance than what grades he obtains in his theoretical studies. When grades measure success in work after graduation more accurately than they do now, the accuracy with which psychological examinations predict academic success will be of higher significance.

The results of this investigation indicate that definite conclusions can be drawn in a surprisingly small number of instances. The numerous unsolved questions suggest further research. Recommendations for further study follow:

1. That an analysis be made of other factors which affect academic success in Teachers College. That tests be devised to measure these factors and that studies be made of the value of these tests in predicting grades.

2. That departmental placement tests be devised for students in the School of Practical Arts.

3. That additional individual tests for the General Examination be devised which correlate more highly with grades but less highly with each other.

4. That a study be made of the undergraduate students in Teachers College.

5. That a more thorough study be made over a longer period of time of the candidates for the Doctor's degree.

6. That "follow-up" studies be made of students after they have left Teachers College in order to:

- a) Analyze success in work.

- b) Find the relation between General Examination, additional test scores, and success in work.

- c) Find the relation between grades and success in work.

APPENDIX

STUDENTS' QUESTIONNAIRE

The following letter and questionnaire were sent to all students who varied more than 9 or less than 3 T scores between the score of the General Examination given in October, 1927, and grades for the first semester of the academic year, 1927-28.

The committee in charge of the General Examination Research is desirous of finding out the reasons for the discrepancies between class grades and scores in the General Examination.

The questionnaires are in code numbers, and the responses will be held confidential. Your responses will not affect your class grades nor your standing in the college in any way but will be useful in advising students in the future.

This questionnaire is being sent to only a portion of the students in Teachers College and is no indication of the scores made on the General Examination.

Since complete records are necessary we would appreciate your coöperation in filling out this questionnaire in full.

Write the number of the correct response in the margin at the right.

Underline *Yes* or *No* in margin.

Write responses requiring more than one word on line following the question.

- | | |
|--|--|
| <p>1. Do you feel that you did your best on the General Examination of October 1 and 8, 1927?</p> <p>2. Had you taken any intelligence test before you took the General Examination?</p> <p>3. Name the examinations and the dates you took them. ...

 </p> <p>4. What was your attitude during the examination?
 a) Very nervous.
 b) Slightly nervous.
 c) Tense.
 d) Calm.
 e) Indifferent.</p> | <p><i>Yes</i> <i>No</i>.</p> <p><i>Yes</i> <i>No</i>.</p> <p>.....</p> |
|--|--|

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5. What was your physical condition during the examination?
 - First day*
 - a) Very ill.
 - b) Slightly indisposed.
 - c) Well.
 (Indicate nature of illness.)
 - Second Day*
 - a) Very ill.
 - b) Slightly indisposed.
 - c) Well.
 (Indicate nature of illness.)
6. Which day do you think you did better?
 - a) First day.
 - b) Second day.
 Reason:

7. At the time you took the General Examination what did you think the purpose of the examination was?

8. Were you affected by the examiner's presence in the room during the examination? *Yes* *No*.
 In what way?
9. Did the time element influence your ability to work during the examination? *Yes* *No*.
10. What was your attitude toward the General Examination?

11. What is your method of working during any examination?
 - a) Work very quickly—never check answers.
 - b) Work quickly—usually check, if possible.
 - c) Work at normal rate.
 - d) Work slowly—do not check.
 - e) Work slowly—usually check.
12. Did you feel handicapped by:
 - a) Age?
 - b) Lack of teaching experience?
 - c) Poor eyesight?
 - d) Poor hearing?
 - e) Anything else? What?
13. Which of the following do you think is your strongest point?
 What do you think the next strongest?
 Which is a little weaker?
 Which is your weakest point?

T TABLES
PART I—THORNDIKE TEST

TEST SCORE	T SCORE	TEST SCORE	T SCORE	TEST SCORE	T SCORE
0-6	14	81-83	38	166-169	62
7-12	15	84-87	39	170-173	63
13-15	16	88-91	40	174-177	64
16-19	17	92-95	41	178-181	65
20-21	18	96-99	42	182-185	66
23-25	19	100-102	43	186-189	67
26-28	20	103-105	44	190-192	68
29-30	21	106-109	45	193-195	69
31-33	22	110-113	46	196-199	70
34-35	23	114-116	47	200-202	71
36-38	24	117-119	48	203-205	72
39-41	25	120-122	49	206-208	73
42-45	26	123-125	50	209-211	74
46-48	27	126-129	51	212-214	75
49-50	28	130-133	52	215-217	76
51-53	29	134-136	53	218-221	77
54-56	30	137-140	54	222-225	78
57-60	31	140-143	55	226-227	79
61-63	32	144-147	56	228-230	80
64-66	33	148-151	57	231-232	81
67-70	34	152-155	58	233-234	82
71-73	35	156-158	59	235-236	83
74-76	36	159-162	60	237-239	84
77-80	37	163-165	61		

PART III—THORNDIKE TEST

TEST SCORE	T SCORE	TEST SCORE	T SCORE	TEST SCORE	T SCORE
0-3	13	90-92	38	191-193	63
4-5	14	93-95	39	194-197	64
6-8	15	96-99	40	198-201	65
9-12	16	100-103	41	202-205	66
13-15	17	104-107	42	206-209	67
16-18	18	108-111	43	210-213	68
19-20	19	112-115	44	214-216	69
21-23	20	116-119	45	217-219	70
24-25	21	120-123	46	220-222	71
26-29	22	124-127	47	223-225	72
30-33	23	128-131	48	226-228	73
34-37	24	132-135	49	229-231	74
38-41	25	136-139	50	232-233	75
42-46	26	140-143	51	234-236	76
47-51	27	144-147	52	237-239	77
52-55	28	148-151	53	240-243	78
56-59	29	152-156	54	244-246	79
60-63	30	157-161	55	247-249	80
64-67	31	162-166	56	250-253	81
68-71	32	167-171	57	254-256	82
72-75	33	172-175	58	257-258	83
76-79	34	176-179	59	259-261	84
80-82	35	180-183	60	262-264	85
83-85	36	184-186	61	265-269	86
86-89	37	187-190	62		

PART IV—READING TEST

TEST SCORE	T SCORE	TEST SCORE	T SCORE	TEST SCORE	T SCORE
0-2	15	66-68	38	112-113	61
3-4	16	69-70	39	114	62
5	17	71-73	40	115-116	63
6-7	18	74-75	41	117	64
8-9	19	76-78	42	118-119	65
10-12	20	79-80	43	120	66
13-15	21	81-82	44	121	67
16-19	22	83-85	45	122	68
20-24	23	86-87	46	123-124	69
25-29	24	88-89	47	125	70
30-32	25	90-91	48	126	71
33-34	26	92-93	49	127	72
35-37	27	94-95	50	128	73
38-40	28	96-97	51	129	74
41-43	29	98-99	52	130	75
44-45	30	100-101	53	131	76
46-48	31	102	54	132	77
49-50	32	103-104	55		78
51-52	33	105-106	56	133	79
53-55	34	107	57		80
56-58	35	108-109	58	134	81
59-62	36	110	59		82
63-65	37	111	60	135	83
				136	84

PART VII—VOCABULARY TEST

TEST SCORE	T SCORE	TEST SCORE	T SCORE	TEST SCORE	T SCORE
0-1	13	29	37	63-64	61
2-3	14	30	38	65	62
4	15	31-32	39	66-67	63
5	16	33	40	68-69	64
6	17	34	41	70	65
7	18	35	42	71-72	66
8	19	36-37	43	73-74	67
9	20	38	44	75	68
10	21	39-40	45	76-77	69
11-12	22	41	46	78	70
13	23	42	47	79-80	71
14	24	43-44	48	81	72
15	25	45	49	82	73
16	26	46-47	50	83	74
17	27	48	51	84	75
18	28	49-50	52	85	76
19	29	51	53	86	77
20	30	52	54	87	78
21-22	31	53-54	55	88	79
23	32	55	56	89	80
24	33	56-57	57	90	81
25	34	58-59	58	91	82
26-27	35	60	59	92-93	83
28	36	61-62	60	94	84

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